Illicit Discharge Detection and Elimination (IDDE) Plan

Town of Maynard, Massachusetts

September 1, 2021

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Town of Maynard, Massachusetts

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1 Introduction

1.1 MS4 Program

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by Maynard to address the requirements of the United States Environmental Protection Agency's (USEPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the "2016 Massachusetts MS4 Permit" or "MS4 Permit."

The 2016 Massachusetts MS4 Permit requires that each permittee, or regulated community, address six Minimum Control Measures. These measures include the following:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination Program
4. Construction Site Stormwater Runoff Control
5. Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management); and
6. Good Housekeeping and Pollution Prevention for Permittee Owned Operations.

Under Minimum Control Measure 3, the permittee is required to implement an IDDE program to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges. The IDDE program must also be recorded in a written (hardcopy or electronic) document. This IDDE Plan has been prepared to address this requirement.

1.2 Illicit Discharges

An "illicit discharge" is any discharge to a drainage system that is not composed entirely of stormwater, with the exception of discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the MS4) and discharges resulting from fire-fighting activities.

Illicit discharges may take a variety of forms. Illicit discharges may enter the drainage system through direct or indirect connections. Direct connections may be relatively obvious, such as cross-connections of sewer services to the storm drain system. Indirect illicit discharges may be more difficult to detect or address, such as failing septic systems that discharge untreated sewage to a ditch within the MS4, or a sump pump that discharges contaminated water on an intermittent basis.

Some illicit discharges are intentional, such as dumping used oil (or other pollutants) into catch basins, a resident or contractor illegally tapping a new sewer lateral into a storm drain pipe to avoid the costs of a sewer connection fee and service, and illegal dumping of yard wastes into surface waters.
Some illicit discharges are related to the unsuitability of original infrastructure to the modern regulatory environment. Examples of illicit discharges in this category include connected floor drains in old buildings, as well as sanitary sewer overflows that enter the drainage system. Sump pumps legally connected to the storm drain system may be used inappropriately, such as for the disposal of floor

washwater or old household products, in many cases due to a lack of understanding on the part of the homeowner.

Elimination of some discharges may require substantial costs and efforts, such as funding and designing a project to reconnect sanitary sewer laterals. Others, such as improving self-policing of dog waste management, can be accomplished by outreach in conjunction with the minimal additional cost of dog waste bins and the municipal commitment to disposal of collected materials on a regular basis.

Regardless of the intention, when not addressed, illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to surface waters.

1.3 Allowable Non-Stormwater Discharges

The following categories of non-stormwater discharges are allowed under the MS4 Permit unless the permittee, USEPA, or Massachusetts Department of Environmental Protection (MassDEP) identifies any category or individual discharge of non-stormwater discharge as a significant contributor of pollutants to the MS4:

- Water line flushing
- Landscape irrigation or lawn watering
- Diverted stream flows
- Rising ground water
- Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
- Uncontaminated pumped groundwater
- Discharge from potable water sources
- Foundation drains or footing drains (not including active groundwater dewatering systems)
- Air conditioning condensation
- Irrigation water, springs
- Natural riparian habitat or wetland flows
- Water from crawl space pumps
- Individual resident car washing
- De-chlorinated swimming pool discharges
- Street wash waters
- Residential building wash waters without detergents
- Fire-fighting activities
- Other water source not containing pollutants

If these discharges are identified as significant contributors to the MS4, they must be considered an "illicit discharge" and addressed in the IDDE Plan (i.e., control these sources so they are no longer significant contributors of pollutants, and/or eliminate them entirely).

1.4 Receiving Waters and Impairments

Table 1-1 lists the "impaired waters" within the boundaries of Maynard's regulated area based on the 2016 Massachusetts Integrated List of Waters. Impaired waters are water bodies that do not meet water quality standards for one or more designated use(s) such as recreation or aquatic habitat.

Table 1-1. Impaired Waters

Maynard, Massachusetts

Water Body Name	Segment ID	Category	Impairment(s)	Associated Approved TMDL
Puffers Pond	MA82092	5	Mercury in Fish Tissue	
Assabet River	MA82B-05	5	Debris/Floatables/Trash Non-Native Aquatic Plants Aquatic Plants (Macrophytes) Excess Algal Growth Fecal Coliform Nutrient/Eutrophication Biological Indicators Dissolved Oxygen Total Phosphorus Taste and Odor E. coli	Assabet River Total Maximum Daily Load for Total Phosphorus. TMDL Report MA82B-01-2004-01
Assabet River	MA82B-06	5	Debris/Floatables/Trash Non-Native Aquatic Plants Aquatic Plants (Macrophytes) Excess Algal Growth Dissolved Oxygen Total Phosphorus Taste and Odor Water Temperature	Assabet River Total Maximum Daily Load for Total Phosphorus. TMDL Report MA82B-01-2004-01

Category 4a Waters – impaired water bodies with a completed Total Maximum Daily Load (TMDL).
Category 4c Waters – impaired water bodies where the impairment is not caused by a pollutant. No TMDL required.
Category 5 Waters – impaired water bodies that require a TMDL.
"Approved TMDLs" are those that have been approved by EPA as of the date of issuance of the 2016 MS4 Permit.

1.5 IDDE Program Goals, Framework, and Timeline

The goals of the IDDE program are to find and eliminate illicit discharges to municipal separate storm sewer systems and to prevent illicit discharges from happening in the future. The program consists of the following major components as outlined in the MS4 Permit:

- Legal authority and regulatory mechanism to prohibit illicit discharges and enforce this prohibition
- Storm system mapping
- Inventory and ranking of outfalls
- Dry weather outfall screening
- Catchment investigations
- Identification/confirmation of illicit sources
- Illicit discharge removal
- Follow-up screening
- Employee training

The IDDE investigation procedure framework is shown in **Figure 1-1.** The required timeline for implementing the IDDE program is shown in **Table 1-2**.

Figure 1-1. IDDE Investigation Procedure Framework

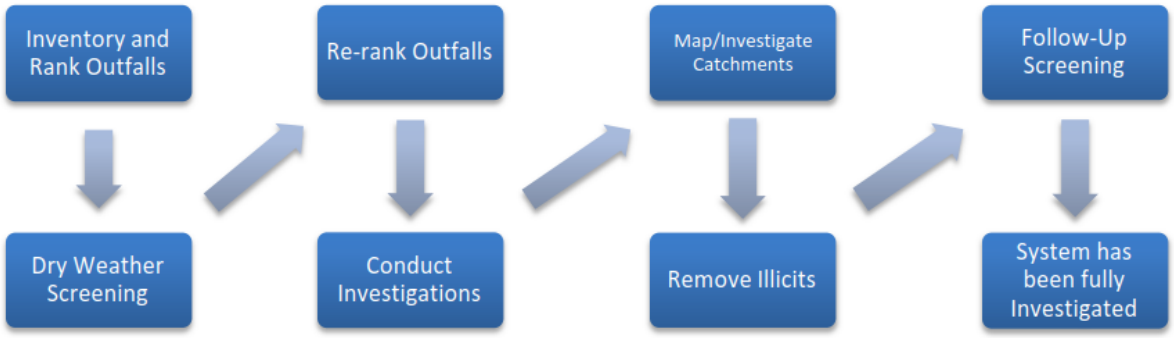


Table 1-2. IDDE Program Implementation Timeline

IDDE Program Requirement	Completion Date from Effective Date of Permit					
	1 Year	1.5 Years	2 Years	3 Years	7 Years	10 Years
Written IDDE Program Plan	X					
SSO Inventory	X					
Written Catchment Investigation Procedure		X				
Phase I Mapping			X			
Phase II Mapping						X
IDDE Regulatory Mechanism or Bylaw (if not already in place)				X		
Dry Weather Outfall Screening				X		
Follow-up Ranking of Outfalls and Interconnections				X		
Catchment Investigations – Problem Outfalls					X	
Catchment Investigations – all Problem, High and Low Priority Outfalls						X

1.6 Work Completed to Date

The 2003 MS4 Permit required each MS4 community to develop a plan to detect illicit discharges using a combination of storm system mapping, adopting a regulatory mechanism to prohibit illicit discharges and enforce this prohibition, and identifying tools and methods to investigate suspected illicit discharges. Each MS4 community was also required to define how confirmed discharges would be eliminated and how the removal would be documented.

The Town of Maynard has completed the following IDDE program activities consistent with the 2003 MS4 Permit requirements:

- Developed a map of outfalls and receiving waters
- Adopted an IDDE bylaw

2 Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

The Town of Maynard adopted the Storm Drain System Bylaw (Chapter XXVIII) in 2007. A copy of the Storm Drain System Bylaw is provided in **Appendix A**. The Storm Drain System Bylaw provides the Town of Maynard with adequate legal authority to:

- Prohibit illicit discharges
- Investigate suspected illicit discharges
- Eliminate illicit discharges, including discharges from properties not owned by or controlled by the MS4 that discharge into the MS4 system
- Implement appropriate enforcement procedures and actions.

The Town of Maynard will continue to enforce the Storm Drain System Bylaw.

2.2 Statement of Responsibilities

The Department of Public Works is the lead municipal department responsible for implementing the IDDE program pursuant to the provisions of the Storm Drain System Bylaw. Other departments with responsibility for aspects of the program include:

- Building Inspector – Report to DPW any observations of potential illicit connections of plumbing to storm drains.
- Board of Health – Regulate septic systems; field complaints and report to DPW about spills, dumping, etc.
- Conservation Division – Field complaints and report to DPW any observations of illicit discharges into wetlands and water bodies.
- Fire Department – Respond to reports of spills; contain spills and isolate catch basins to prevent spills from reaching water bodies.

3 Stormwater System Mapping

A copy of the Maynard' storm system map is provided in the Maynard Public MS4 Web Viewer, which can be found at the following link:

https://vhb.maps.arcgis.com/apps/webappviewer/index.html?id=e73dbfc193e24e87beac0814201eaae3

Maynard originally developed mapping of its stormwater system to meet the mapping requirements of the 2003 MS4 Permit. The 2016 MS4 Permit requires a more detailed storm system map than was required by the 2003 MS4 Permit, so Maynard revised mapping in during Permit Years 1 and 2 and continues to update mapping during IDDE activities. The revised mapping is intended to facilitate the identification of key infrastructure, factors influencing proper system operation, and the potential for illicit discharges.

The 2016 MS4 Permit requires the storm system map to be updated in two phases as outlined below. The Department of Public Works is responsible for updating the stormwater system mapping pursuant to the 2016 MS4 Permit. Maynard will report on the progress towards completion of the storm system map in each annual report. Updates to the stormwater mapping will be included in the Maynard Public MS4 Web Viewer (link above).

3.1 Phase I Mapping

Phase I mapping will be completed within two (2) years of the effective date of the permit (by June 30, 2020) and will include the following information:

- Outfalls
- Open channel conveyances (swales, ditches, etc.)
- Interconnections with other MS4s and other storm sewer systems
- Town-owned stormwater treatment structures (e.g., detention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators)
- Water bodies identified by name and indication of all use impairments as identified on the most recent EPA-approved Massachusetts Integrated List of Waters report
- Initial catchment delineations. A catchment is the area that drains to an individual outfall or interconnection.
- Surface public drinking water supplies, watersheds, and protection zones

3.2 Phase II Mapping

Phase II mapping will be completed within ten (10) years of the effective date of the permit (by June 30, 2028) and will include the following information:

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
- Pipes
- Manholes

- Catch basins
- Refined catchment delineations. Catchment delineations must be updated to reflect information collected during catchment investigations.
- Municipal Sanitary Sewer system

4 Sanitary Sewer Overflows (SSOs)

The 2016 MS4 Permit requires municipalities to prohibit illicit discharges, including sanitary sewer overflows (SSOs), to the separate storm sewer system. SSOs are discharges of untreated sanitary wastewater from a municipal sanitary sewer that can contaminate surface waters, cause serious water quality problems and property damage, and threaten public health. SSOs can be caused by blockages, line breaks, sewer defects that allow stormwater and groundwater to overload the system, power failures, improper sewer design, and vandalism.

Maynard has completed an inventory of SSOs that have discharged to the MS4 within the five (5) years prior to the effective date of the 2016 MS4 Permit, based on review of available documentation pertaining to SSOs (**Table 4-1**). The inventory includes all SSOs that occurred during wet or dry weather resulting from inadequate conveyance capacities or where interconnectivity of the storm and sanitary sewer infrastructure allows for transfer of flow between systems.

Upon detection of an SSO, Maynard will eliminate it as expeditiously as possible and take interim measures to minimize the discharge of pollutants to and from its MS4 until the SSO is eliminated. Maynard will provide oral notice within 24 hours to MassDEP, EPA, and other relevant parties, and will follow up the verbal notification with a written report following MassDEP's Sanitary Sewer Overflow (SSO)/Bypass notification form within 5 calendar days of becoming aware of the overflow, bypass, or backup. For more information, see https://www.mass.gov/how-to/sanitary-sewer-overflowbypassbackup-notification

- DEP 24-hour Emergency Line 1-888-304-1133

- DEP Central Region (508) 792-7650
  8 New Bond Street
  Worcester, MA 01606

- EPA New England
  (617) 918-1510
  Post Office Square
  Boston, MA 02109

The inventory in **Table 4-1** will be updated by the DPW when new SSOs are detected. The SSO inventory will be included in the annual report, including the status of mitigation and corrective measures to address each identified SSO.

Table 4-1. SSO Inventory

Maynard, Massachusetts
Revision Date: September 1, 2021

SSO Location[1]	Discharge Statement[2]	Date[3]	Time Start[3]	Time End[3]	Estimated Volume[4]	Description[5]	Mitigation Completed[6]	Mitigation Planned[7]
Florida Street Bridge	Direct to Assabet River	September 2015			Unknown	MassDOT inspected the Florida Street Bridge and found a crack in the pipe beneath the bridge.	Replaced 130 LF of sewer pipe	

[1] Location (approximate street crossing/address and receiving water, if any)
[2] A clear statement of whether the discharge entered a surface water directly or entered the MS4
[3] Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge)
[4] Estimated volume(s) of the occurrence
[5] Description of the occurrence indicating known or suspected cause(s)
[6] Mitigation and corrective measures completed with dates implemented
[7] Mitigation and corrective measures planned with implementation schedules

5 Assessment and Priority Ranking of Outfalls

The 2016 MS4 Permit requires an assessment and priority ranking of outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. The ranking helps determine the priority order for performing IDDE investigations and meeting permit milestones.

5.1 Outfall Catchment Delineations

A catchment is the area that drains to an individual outfall[1] or interconnection.[2] The catchments for each of the MS4 outfalls will be delineated to define contributing areas for investigation of potential sources of illicit discharges. Catchments are typically delineated based on topographic contours and mapped drainage infrastructure, where available. As described in **Section 3**, initial catchment delineations will be completed as part of the Phase I mapping, and refined catchment delineations will be completed as part of the Phase II mapping to reflect information collected during catchment investigations

5.2 Outfall and Interconnection Inventory and Initial Ranking

DPW has completed an outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The inventory and ranking is updated annually to include data collected in connection with dry weather screening and other relevant inspections.

The outfall and interconnection inventory will identify each outfall and interconnection discharging from the MS4, record its location and condition, and provide a framework for tracking inspections, screenings and other IDDE program activities.

Outfalls and interconnections have been and will continue to be classified into one of the following categories:

1. **Problem Outfalls**: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall include any outfalls/interconnections where previous screening indicates likely sewer input. Likely sewer input indicators are any of the following:

    - Olfactory or visual evidence of sewage,

[1] **Outfall** means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.

[2] **Interconnection** means the point (excluding sheet flow over impervious surfaces) where the permittee's MS4 discharges to another MS4 or other storm sewer system, through which the discharge is conveyed to waters of the United States or to another storm sewer system and eventually to a water of the United States.

- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

Dry weather screening and sampling, as described in **Section 6** of this IDDE Plan and Part 2.3.4.7.b of the MS4 Permit, is not required for Problem Outfalls.

2. **High Priority Outfalls**: Outfalls/interconnections that have not been classified as Problem Outfalls and that are:

    - Discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds
    - Determined by the permittee as high priority based on the characteristics listed below or other available information.

3. **Low Priority Outfalls**: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.

4. **Excluded outfalls**: Outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program. This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.

Ranking Characteristics

Outfalls will be ranked into the above priority categories (except for excluded outfalls, which may be excluded from the IDDE program) based on the following characteristics of the defined initial catchment areas, where information is available. Additional relevant characteristics, including location-specific characteristics, may be considered but must be documented in this IDDE Plan.

- **Previous screening results** – previous screening/sampling results indicate likely sewer input (see criteria above for Problem Outfalls).

    September 2021 Status: Outfall investigations during dry weather have found five outfalls with indication of likely sewer input.

- **Past discharge complaints and reports.**

    September 2021 Status: DPW has not received complaints or reports related to illicit discharges.

- **Poor receiving water quality** – the following guidelines are recommended to identify waters as having a high illicit discharge potential:
    - Exceeding water quality standards for bacteria
    - Ammonia levels above 0.5 mg/l
    - Surfactants levels greater than or equal to 0.25 mg/l

September 2021 Status: Recent water quality sampling data are not available.

- **Density of generating sites** – Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and industrial manufacturing areas.

September 2021 Status: Maynard contains around 15 car dealers and repair shops, one car wash, and no industrial sites. Generating sites are distributed evenly throughout town and are not concentrated within particular catchment areas.

- **Age of development and infrastructure** – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old will probably have a high illicit discharge potential. Developments 20 years or younger will probably have a low illicit discharge potential.

September 2021 Status: Many parts of Maynard have sanitary sewer greater than 40 years old. This information is not yet mapped but will be part of future outfall ranking updates.

- **Sewer conversion** – Contributing catchment areas that were once serviced by septic systems, but have been converted to sewer connections may have a high illicit discharge potential.

September 2021 Status: This information is not yet mapped but will be part of future outfall ranking updates.

- **Historic combined sewer systems** – Contributing areas that were once serviced by a combined sewer system but have been separated may have a high illicit discharge potential.

September 2021 Status: To our knowledge, Maynard was not ever serviced by combined sewer system.

- **Surrounding density of aging septic systems** – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.

September 2021 Status: This information is not yet mapped but will be part of future outfall ranking updates. Maynard is in the process of mapping and collecting information about the remaining septic systems in town and currently knows of 148 households on septic.

- **Culverted streams** – Any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.

September 2021 Status: This information is not yet mapped but will be part of future outfall ranking updates.

- **Water quality limited water bodies** that receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to contain the pollutant identified as the cause of the water quality impairment.

  September 2021 Status: Assabet River segment MA82B-05 is listed in the 2016 Integrated List of Waters as impaired for E. coli. The river segment extends from the Hudson WWTP discharge in Hudson to the USGS gage at Routes 27/62 in Maynard.

  The entire length of Assabet River in Maynard is impaired for phosphorus and is covered by the Final Phosphorus TMDL for Assabet River.

The current outfall priority ranking is based on outfall discharge location and sampling results from Dry Weather Screening activities. All outfalls that discharge directly to the Assabet River are considered high priority due to the water body's importance to the Town and current impaired status. Of the high priority outfalls, five outfalls had sampling results that suggest potential sewer input. These five outfalls are considered highest priority. All other outfalls are considered low priority. Priority rankings will be continue to be revised annually as more data becomes available.

Table 5-1 provides Maynard's current outfall inventory and priority ranking matrix.

Table 5-1. Outfall Inventory and Priority Ranking Matrix

Maynard, Massachusetts
Revision Date: September 2021

Outfall ID	IDDE Priority	Receiving Waterbody
OF-143	Highest	Assabet River: MA82B-05
OF-208	Highest	Assabet River: MA82B-05
OF-222	Highest	Assabet River: MA82B-05
OF-223	Highest	Assabet River: MA82B-05
OF-63	Highest	Assabet River: MA82B-05
OF-1	High	Assabet River: MA82B-05
OF-10	High	Assabet River: MA82B-05
OF-11	High	Assabet River: MA82B-05
OF-115	High	Assabet River: MA82B-05
OF-116	High	Assabet River: MA82B-05
OF-117	High	Assabet River: MA82B-05
OF-118	High	Assabet River: MA82B-05
OF-12	High	Assabet River: MA82B-05
OF-13	High	Assabet River: MA82B-06
OF-133	High	Assabet River: MA82B-05
OF-134	High	Assabet River: MA82B-05
OF-135	High	Assabet River: MA82B-05
OF-140	High	Assabet River: MA82B-05
OF-141	High	Assabet River: MA82B-05
OF-142	High	Assabet River: MA82B-05
OF-144	High	Assabet River: MA82B-05
OF-145	High	Assabet River: MA82B-05
OF-147	High	Assabet River: MA82B-05
OF-148	High	Assabet River: MA82B-05
OF-149	High	Assabet River: MA82B-05
OF-16	High	Assabet River: MA82B-06
OF-17	High	Assabet River: MA82B-06
OF-19	High	Assabet River: MA82B-05
OF-197	High	Assabet River: MA82B-05
OF-198	High	Assabet River: MA82B-05
OF-2	High	Assabet River: MA82B-05
OF-20	High	Assabet River: MA82B-05
OF-200	High	Assabet River: MA82B-05
OF-201	High	Assabet River: MA82B-05
OF-203	High	Assabet River: MA82B-05
OF-204	High	Assabet River: MA82B-05
OF-205	High	Assabet River: MA82B-05
OF-207	High	Assabet River: MA82B-05
OF-209	High	Assabet River: MA82B-05
OF-21	High	Assabet River: MA82B-05
OF-210	High	Assabet River: MA82B-05

Outfall ID	IDDE Priority	Receiving Waterbody
OF-211	High	Assabet River: MA82B-05
OF-212	High	Assabet River: MA82B-05
OF-213	High	Assabet River: MA82B-05
OF-214	High	Assabet River: MA82B-05
OF-215	High	Assabet River: MA82B-05
OF-216	High	Assabet River: MA82B-05
OF-217	High	Assabet River: MA82B-06
OF-218	High	Assabet River: MA82B-06
OF-220	High	Assabet River: MA82B-06
OF-221	High	Assabet River: MA82B-06
OF-224	High	Assabet River: MA82B-06
OF-242	High	Assabet River: MA82B-05
OF-3	High	Assabet River: MA82B-06
OF-5	High	Assabet River: MA82B-05
OF-62	High	Assabet River: MA82B-05
OF-7	High	Assabet River: MA82B-06
OF-81	High	Assabet River: MA82B-05
OF-82	High	Assabet River: MA82B-05
OF-89	High	Assabet River: MA82B-05
OF-90	High	Assabet River: MA82B-05
OF-91	High	Assabet River: MA82B-05
OF-92	High	Assabet River: MA82B-05
OF-94	High	Assabet River: MA82B-06
OF-102	Low	Other
OF-107	Low	Other
OF-108	Low	Other
OF-109	Low	Other
OF-110	Low	Other
OF-111	Low	Other
OF-112	Low	Other
OF-113	Low	Other
OF-114	Low	Other
OF-119	Low	Other
OF-120	Low	Other
OF-121	Low	Other
OF-122	Low	Other
OF-123	Low	Other
OF-124	Low	Other
OF-125	Low	Other
OF-126	Low	Other
OF-127	Low	Other
OF-128	Low	Other
OF-129	Low	Other
OF-130	Low	Other
OF-136	Low	Other
OF-137	Low	Other

Outfall ID	IDDE Priority	Receiving Waterbody
OF-139	Low	Other
OF-150	Low	Other
OF-151	Low	Other
OF-195	Low	Other
OF-199	Low	Other
OF-22	Low	Other
OF-225	Low	Other
OF-226	Low	Other
OF-227	Low	Other
OF-228	Low	Other
OF-229	Low	Other
OF-23	Low	Other
OF-230	Low	Other
OF-231	Low	Other
OF-233	Low	Other
OF-234	Low	Other
OF-235	Low	Other
OF-236	Low	Other
OF-237	Low	Other
OF-238	Low	Other
OF-239	Low	Other
OF-24	Low	Other
OF-240	Low	Other
OF-241	Low	Other
OF-25	Low	Other
OF-4	Low	Other
OF-64	Low	Other
OF-69	Low	Other
OF-70	Low	Other
OF-73	Low	Other
OF-74	Low	Other
OF-75	Low	Other
OF-76	Low	Other
OF-78	Low	Other
OF-8	Low	Other
OF-80	Low	Other
OF-83	Low	Other
OF-84	Low	Other
OF-87	Low	Other
OF-88	Low	Other
OF-9	Low	Other
OF-93	Low	Other
OF-95	Low	Other
OF-97	Low	Other

N/A: Information not yet available but will be considered for future ranking updates

Scoring Criteria:

[1] Outfalls/interconnections that discharge to or in the vicinity of any of the following areas: public beaches, recreational areas, drinking water supplies, or shellfish beds

[2] Receiving water quality based on latest version of MassDEP Integrated List of Waters.

- Poor = Waters with approved TMDLs (Category 4a Waters) where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment
- Fair = Water quality limited water bodies that receive a discharge from the MS4 (Category 5 Waters)
- Good = No water quality impairments

[3] Generating sites are institutional, municipal, commercial, or industrial sites with a potential to contribute to illicit discharges (e.g., car dealers, car washes, gas stations, garden centers, industrial manufacturing, etc.)

[4] Age of development and infrastructure:

- High = Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old
- Medium = Developments 20-40 years old
- Low = Developments less than 20 years old

[5] Areas once served by combined sewers and but have been separated, or areas once served by septic systems but have been converted to sanitary sewers.

[6] Aging septic systems are septic systems 30 years or older in residential areas.

[7] Any river or stream that is culverted for distance greater than a simple roadway crossing.

6 Dry Weather Outfall Screening and Sampling

Dry weather flow is a common indicator of potential illicit connections. The MS4 Permit requires all outfalls/interconnections (excluding Problem and excluded Outfalls) to be inspected for the presence of dry weather flow. The DPW is responsible for conducting dry weather outfall screening, starting with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings described in the previous section.

6.1 Weather Conditions

Dry weather outfall screening and sampling may occur when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. For purposes of determining dry weather conditions, DPW staff will use precipitation data available online at Weather Underground (wunderground.com) for three personal weather stations within or closest to Maynard. If any of the three stations document more than 0.1 inches of rainfall in the previous 24-hour period, DPW staff will not count that as a dry weather period.

6.2 Dry Weather Screening/Sampling Procedure

6.2.1 General Procedure

The dry weather outfall inspection and sampling procedure consists of the following general steps:

1. Identify outfall(s) to be screened/sampled based on initial outfall inventory and priority ranking.
2. Acquire the necessary staff, mapping, and field equipment (see **Table 6-1** for list of potential field equipment).
3. Conduct the outfall inspection during dry weather:
    a. Mark and photograph the outfall
    b. Record the inspection information and outfall characteristics (using digital form with a tablet or similar device) (see form in **Appendix B**).
    c. Look for and record visual/olfactory evidence of pollutants in flowing outfalls including odor, color, turbidity, and floatable matter (suds, bubbles, excrement, toilet paper or sanitary products). Also observe outfalls for deposits and stains, vegetation, and damage to outfall structures.
4. If flow is observed, sample and test the flow following the procedures described in the following sections.
5. If no flow is observed, but evidence of illicit flow exists (illicit discharges are often intermittent or transitory), revisit the outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow. Other techniques can be used to detect intermittent or transitory flows including conducting inspections during evenings or weekends, and using optical brighteners.
6. Input results from screening and sampling into database. Include pertinent information in the outfall/interconnection inventory and priority ranking.
7. Include all screening data in the annual report.

Previous outfall screening/sampling conducted under the 2003 MS4 Permit may be used to satisfy the dry weather outfall/screening requirements of the 2016 MS4 Permit only if the previous screening and sampling was substantially equivalent to that required by the 2016 MS4 Permit, including the list of analytes outlined in Section 2.3.4.7.b.iii.4 of the 2016 permit.

6.2.2 Field Equipment

Table 6-1 lists field equipment commonly used for dry weather outfall screening and sampling.

Table 6-1. Field Equipment – Dry Weather Outfall Screening and Sampling

Equipment	Use/Notes
Clipboard	For organization of field sheets and writing surface
Mobile Device with Collector or Field Maps, including camera and GPS	Mobile device used for conducting dry weather screening/sampling. Also used for taking photos and geospatial locating of structures.
Chain of Custody Forms	To ensure proper handling of all samples
Pens/Pencils/Permanent Markers	For proper labeling
Nitrile Gloves	To protect the sampler as well as the sample from contamination
Flashlight/headlamp w/batteries	For looking in outfalls or manholes, helpful in early mornings as well
Cooler with Ice	For transporting samples to the laboratory
Personal Protective Equipment (PPE)	Reflective vest, Safety glasses and boots at a minimum
Water Quality Sonde	If needed, for sampling conductivity, temperature, pH
Water Quality Meters/Test Kits	Handheld meters and test kits for testing for various water quality parameters such as ammonia, surfactants, and chlorine. See Table 6-2 below for meters used.
Test Kits	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
Label Tape	For labeling sample containers
Sample Containers	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria requires sterile containers).
Pry Bar or Pick	For opening catch basins and manholes when necessary
Small Mallet or Hammer	Helping to free stuck manhole and catch basin covers
Utility Knife	Multiple uses
Hand Sanitizer	Disinfectant/decontaminant
Zip Ties/Duct Tape	For making field repairs
Rubber Boots/Waders	For accessing shallow streams/areas
Sampling Pole/Dipper/Sampling Cage	For accessing hard to reach outfalls and manholes

6.2.3 Sample Collection and Analysis

If flow is present during a dry weather outfall inspection, a sample will be collected and analyzed for the required permit parameters[3] listed in **Table 6-2**. The general procedure for collection of outfall samples is as follows:

1. At least one day prior to outfall sampling, coordinate with Alpha Analytical, Inc. to schedule the laboratory analysis (716-783-9291). This coordination will include the time of delivery and/or courier drop-off and number of samples expected to be sent for analysis. Confirm with Alpha Analytical if any hold time issues are anticipated.
2. Fill out all sample information on sample bottles and field sheets (see **Appendix B** for Sample Labels and Field Sheets).
3. Put on protective gloves (nitrile/latex/other) before sampling.
4. Collect sample with dipper or in grab sample bottle. Be careful not to disturb sediments.
5. Triple rinse dipper or grab sample bottle in water to be sampled.
6. Use test strips, test kits, and field meters (rinse similar to dipper) for most parameters (see **Table 6-2**).
7. Fill laboratory sample bottles with sample from grab bottle. Be careful not to disturb or spill preservatives in laboratory sample bottle.
8. Place laboratory samples on ice for analysis of bacteria and pollutants of concern.
9. Fill out chain-of-custody form for laboratory samples.
10. Contact laboratory for lab sample pick up.
11. Dispose of used test strips and test kit ampules properly.
12. Decontaminate all testing personnel and equipment.

In the event that an outfall is submerged, either partially or completely, or inaccessible, field staff will proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results. Field staff will continue to the next upstream structure until there is no longer an influence from the receiving water on the visual inspection or sampling. If field staff are unable to access the next upstream structure due to safety concerns (e.g., need for traffic control), the structure will be marked for follow-up and staff will return once safety concerns are appropriately mitigated.

Field test kits or field instrumentation are permitted for all parameters except indicator bacteria and any pollutants of concern. Field kits need to have appropriate detection limits and ranges. **Table 6-2** lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters, other than indicator bacteria and any pollutants of concern. Analytic procedures and user's manuals for field test kits and field instrumentation are provided in **Appendix D**.

[3] Other potentially useful parameters, although not required by the MS4 Permit, include **fluoride** (indicator of potable water sources in areas where water supplies are fluoridated), **potassium** (high levels may indicate the presence of sanitary wastewater), and **optical brighteners** (indicative of laundry detergents).

Table 6-2. Sampling Parameters and Analysis Methods

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	NA	Hach™ Ammonia Test Strips
Surfactants (Detergents)	NA	CHEMetrics™ K-9400
Chlorine	CHEMetrics™ V-2000, K-2513 Hach™ DR300 Pocket Colorimeter™ II	NA
Conductivity	EXTECH EC500	NA
Temperature	EXTECH EC500	NA
Salinity	EXTECH EC500	NA
Temperature	EXTECH EC500	NA
Indicator Bacteria: *E. coli* (freshwater) or Enterococcus (saline water)	EPA certified laboratory procedure (40 CFR § 136)	NA
Pollutants of Concern[1]	EPA certified laboratory procedure (40 CFR § 136)	NA

[1] Where the discharge is directly into a water quality limited water or a water subject to an approved TMDL, the sample must be analyzed for the pollutant(s) of concern identified as the cause of the water quality impairment.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.[4] Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. **Table 6-3** lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters.

[4] 40 CFR § 136: http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5

Table 6-3. Required Analytical Methods, Detection Limits, Hold Times, and Preservatives[4]

Analyte or Parameter	Analytical Method	Detection Limit	Max. Hold Time	Preservative
Ammonia	**EPA**: 350.2, **SM**: 4500-NH3C	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2, No preservative required if analyzed immediately
Surfactants	**SM**: 5540-C	0.01 mg/L	48 hours	Cool ≤6°C
Chlorine	**SM**: 4500-Cl G	0.02 mg/L	Analyze within 15 minutes	None Required
Temperature	**SM**: 2550B	*NA*	Immediate	None Required
Specific Conductance	**EPA**: 120.1, **SM**: 2510B	0.2 µs/cm	28 days	Cool ≤6°C
Salinity	**SM**: 2520	-	28 days	Cool ≤6°C
Indicator Bacteria: *E. coli*	*E. coli* **EPA**: 1603 **SM**: 9221B, 9221F , 9223 B **Other**: Colilert®, Colilert-18®	*E. coli* **EPA**: 1 cfu/100mL **SM**: 2 MPN/100mL **Other**: 1 MPN/100mL	8 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Total Phosphorus	**EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4 **SM**: 4500-P E-F	**EPA**: 0.01 mg/L **SM** : 0.01 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Total Nitrogen (Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.)	**EPA**: Cadmium reduction (automated)-353.2 Rev. 2.0, **SM**: 4500-NO_3 E-F	**EPA**: 0.05 mg/L **SM** : 0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2

SM = Standard Methods

6.3 Interpreting Outfall Sampling Results

Outfall analytical data from dry weather sampling can be used to help identify the major type or source of discharge. **Table 6-4** shows values identified by the U.S. EPA and the Center for Watershed Protection as typical screening values for select parameters. These represent the typical concentration (or value) of each parameter expected to be found in stormwater. **Screening values that exceed these benchmarks may be indicative of pollution and/or illicit discharges.**

Table 6-4. Benchmark Field Measurements for Select Parameters

Analyte or Parameter	Benchmark
Ammonia	>0.5 mg/L
Conductivity	>2,000 µS/cm
Surfactants	>0.25 mg/L
Chlorine	>0.02 mg/L (detectable levels per the 2016 MS4 Permit)
Indicator Bacteria[5]: *E. coli*	*E. coli*: the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml

6.4 Follow-up Ranking of Outfalls and Interconnections

Maynard will update and re-prioritize the initial outfall and interconnection rankings based on information gathered during dry weather screening. The rankings will be updated completed once dry weather screening is complete, which is expected in September or October of 2021.

Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input are highly likely to contain illicit discharges from sanitary sources. Such outfalls/interconnections will be ranked at the top of the High Priority Outfalls category for investigation. Other outfalls and interconnections may be re-ranked based on any new information from the dry weather screening.

7 Catchment Investigations

Once stormwater outfalls with evidence of illicit discharges have been identified, various methods can be used to trace the source of the potential discharge within the outfall catchment area. Catchment

[5] Massachusetts Water Quality Standards: http://www.mass.gov/eea/docs/dep/service/regulations/314cmr04.pdf

investigation techniques include but are not limited to review of maps, historic plans, and records; manhole observation; dry and wet weather sampling; video inspection; smoke testing; and dye testing. This section outlines a systematic procedure to investigate outfall catchments to trace the source of potential illicit discharges. All data collected as part of the catchment investigations will be recorded and reported in each annual report.

7.1 System Vulnerability Factors

The DPW will review relevant mapping and historic plans and records to identify areas within the catchment with higher potential for illicit connections. The following information will be reviewed:

- Plans related to the construction of the drainage network
- Plans related to the construction of the sewer drainage network
- Prior work on storm drains or sewer lines
- Board of Health or other municipal data on septic systems
- Complaint records related to SSOs
- Septic system breakouts

Based on the review of this information, the presence of any of the following **System Vulnerability Factors (SVFs)** will be identified for each catchment:

- History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages
- Common or twin-invert manholes serving storm and sanitary sewer alignments
- Common trench construction serving both storm and sanitary sewer alignments
- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
- Sanitary sewer alignments known or suspected to have been constructed with an underdrain system
- Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints
- Areas formerly served by combined sewer systems
- Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations
- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs
- Any sanitary sewer and storm drain infrastructure greater than 40 years old
- Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance)
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance).

An SVF inventory will be documented for each catchment (see **Table 7-1**), retained as part of this IDDE Plan, and included in the annual report.

Table 7-1. Outfall Catchment System Vulnerability Factor (SVF) Inventory

Maynard, Massachusetts
Revision Date: [To be completed during Permit Year 4]

Outfall ID	Receiving Water	1 History of SSOs	2 Common or Twin Invert Manholes	3 Common Trench Construction	4 Storm/ Sanitary Crossings (Sanitary Above)	5 Sanitary Lines with Underdrains	6 Inadequate Sanitary Level of Service	7 Areas Formerly Served by Combined Sewers	8 Sanitary Infrastructure Defects	9 SSO Potential	10 Sanitary and Storm Drain Infrastructure >40 years Old	11 Septic with Poor Soils or Water Table Separation	12 History of BOH Actions
#	XYZ River	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

Presence/Absence Evaluation Criteria:

1. History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages
2. Common or twin-invert manholes serving storm and sanitary sewer alignments
3. Common trench construction serving both storm and sanitary sewer alignments
4. Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
5. Sanitary sewer alignments known or suspected to have been constructed with an underdrain system
6. Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints
7. Areas formerly served by combined sewer systems
8. Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations
9. Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs
10. Any sanitary sewer and storm drain infrastructure greater than 40 years old
11. Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance)
12. History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance)

7.2 Dry Weather Manhole Inspections

Maynard will implement a dry weather storm drain network investigation that involves systematically and progressively observing, sampling and evaluating key junction manholes in the MS4 to determine the approximate location of suspected illicit discharges or SSOs.

The DPW will be responsible for implementing the dry weather manhole inspection program and making updates as necessary. Infrastructure information will be incorporated into the storm system map, and catchment delineations will be refined based on the field investigation, where necessary. The SVF inventory will also be updated based on information obtained during the field investigations, where necessary.

Several important terms related to the dry weather manhole inspection program are defined by the MS4 Permit as follows:

- **Junction Manhole** is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.

- **Key Junction Manholes** are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

For all catchments identified for investigation, during dry weather, field crews will systematically inspect **key junction manholes** for evidence of illicit discharges. This program involves progressive inspection and sampling at manholes in the storm drain network to isolate and eliminate illicit discharges.

The manhole inspection methodology will be conducted in one of two ways (or a combination of both):

- By working progressively up from the outfall and inspecting key junction manholes along the way, or
- By working progressively down from the upper parts of the catchment toward the outfall.

For most catchments, manhole inspections will proceed from the outfall moving up into the system. However, the decision to move up or down the system depends on the nature of the drainage system and the surrounding land use and the availability of information on the catchment and drainage system. Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system, but may be more efficient if the sources of illicit discharges are believed to be located in the

upstream portions of the catchment area. Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment.

Inspection of key junction manholes will proceed as follows:

1. Manholes will be opened and inspected for visual and olfactory evidence of illicit connections. A sample field inspection form is provided in **Appendix C**.

2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field kits can be used for these analyses. Sampling and analysis will be in accordance with procedures outlined in **Section 6**. Additional indicator sampling may assist in determining potential sources (e.g., bacteria for sanitary flows, conductivity to detect tidal backwater, etc.).

3. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of sources.

4. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes.

5. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

7.3 Wet Weather Outfall Sampling

Where a minimum of one (1) System Vulnerability Factor (SVF) is identified based on previous information or the catchment investigation, a wet weather investigation must also be conducted at the associated outfall. The DPW will be responsible for implementing the wet weather outfall sampling program and making updates as necessary.

Outfalls will be inspected and sampled under wet weather conditions, to the extent necessary, to determine whether wet weather-induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.

Wet weather outfall sampling will proceed as follows:

1. At least one wet weather sample will be collected at the outfall for the same parameters required during dry weather screening.

2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall. There is no specific rainfall amount that will trigger sampling, although minimum storm event intensities that are likely to trigger sanitary sewer interconnections are preferred. Therefore, wet weather sampling decisions will be at the discretion of the sampling team. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively high.

3. If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, or source isolation and confirmation procedures will be followed as described in **Section 7.4**.

4. If wet weather outfall sampling does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, catchment investigations will be considered complete.

7.4 Source Isolation and Confirmation

Once the source of an illicit discharge is approximated between two manholes, more detailed investigation techniques will be used to isolate and confirm the source of the illicit discharge. The following methods may be used in isolating and confirming the source of illicit discharges

- Sandbagging
- Smoke Testing
- Dye Testing
- CCTV/Video Inspections

These methods are described in the sections below. Instructions and Standard Operating Procedures (SOPs) for these and other IDDE methods are provided in **Appendix F**.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the DPW will notify property owners in the affected area by using robocalls and/or hand-delivered letters.

7.4.1 Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within outlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Sandbags are typically left in place for 48 hours and should only be installed when dry weather is forecast. If flow has collected behind the sandbags/barriers after 48 hours, it can be assessed using visual observations or by sampling. If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge. Finding appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

7.4.2 Smoke Testing

Smoke testing involves injecting non-toxic smoke into drain lines and noting the emergence of smoke from sanitary sewer vents in illegally connected buildings or from cracks and leaks in the system itself. Typically, a smoke bomb or smoke generator is used to inject the smoke into the system at a catch basin or manhole and air is then forced through the system. Test personnel are place in areas where there are suspected illegal connections or cracks/leaks, noting any escape of smoke (indicating an illicit

connection or damaged storm drain infrastructure). It is important when using this technique to make proper notifications to area residents and business owners as well as local police and fire departments.

If the initial test of the storm drain system is unsuccessful then a more thorough smoke-test of the sanitary sewer lines can also be performed. Unlike storm drain smoke tests, buildings that do not emit smoke during sanitary sewer smoke tests may have problem connections and may also have sewer gas venting inside, which is hazardous.

It should be noted that smoke may cause minor irritation of respiratory passages. Residents with respiratory conditions may need to be monitored or evacuated from the area of testing altogether to ensure safety during testing.

7.4.3 Dye Testing

Dye testing involves flushing non-toxic dye into plumbing fixtures such as toilets, showers, and sinks and observing nearby storm drains and sewer manholes as well as stormwater outfalls for the presence of the dye. Similar to smoke testing, it is important to inform local residents and business owners. Police, fire, and local public health staff should also be notified prior to testing in preparation of responding to citizen phone calls concerning the dye and their presence in local surface waters.

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is inside the building, while the others are stationed at the appropriate storm sewer and sanitary sewer manholes (which should be opened) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the plumbing system. The person inside the building then radios to the outside crew that the dye has been dropped, and the outside crew watches for the dye in the storm sewer and sanitary sewer, recording the presence or absence of the dye.

The test can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses.

7.4.4 CCTV/Video Inspection

Another method of source isolation involves the use of mobile video cameras that are guided remotely through stormwater drain lines to observe possible illicit discharges. IDDE program staff can review the videos and note any visible illicit discharges. While this tool is both effective and usually definitive, it can be costly and time consuming when compared to other source isolation techniques.

7.5 Illicit Discharge Removal

When the specific source of an illicit discharge is identified, Maynard will exercise its authority as necessary to require its removal. The annual report will include the status of IDDE investigation and removal activities including the following information for each confirmed source:

- The location of the discharge and its source(s)
- A description of the discharge
- The method of discovery
- Date of discovery
- Date of elimination, mitigation or enforcement action OR planned corrective measures and a schedule for completing the illicit discharge removal
- Estimate of the volume of flow removed.

7.5.1 Confirmatory Outfall Screening

Within one (1) year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening will be conducted. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation.

7.6 Ongoing Screening

Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening and scheduled for ongoing screening once every five (5) years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in **Section 6** of this plan. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to System Vulnerability Factors and will be conducted in accordance with the procedures described in **Section 7.3**. All sampling results will be reported in the annual report.

8 Training

Annual IDDE training will be made available to all DPW employees involved in the IDDE program. This training will at a minimum include information on how to identify illicit discharges and SSOs and may also include additional training specific to the functions of particular personnel and their function within the framework of the IDDE program. Training records will be maintained in **Appendix E**. The frequency and type of training will be included in the annual report.

9 Progress Reporting

The progress and success of the IDDE program will be evaluated on an annual basis. The evaluation will be documented in the annual report and will include the following indicators of program progress:

- Number of SSOs and illicit discharges identified and removed
- Number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure
- Number of dry weather outfall inspections/screenings
- Number of wet weather outfall inspections/sampling events
- Number of enforcement notices issued
- All dry weather and wet weather screening and sampling results
- Estimate of the volume of sewage removed, as applicable
- Number of employees trained annually.

The success of the IDDE program will be measured by the IDDE activities completed within the required permit timelines.

Appendix A

Legal Authority (IDDE Bylaw)

TOWN OF MAYNARD

BY-LAWS

CHAPTER XXVIII

STORM DRAIN SYSTEM

Section 1: Purpose

(a) Increased and contaminated stormwater runoff is a major cause of impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater; contamination of drinking water supplies; alteration or destruction of aquatic and wildlife habitat; and flooding.

(b) Regulation of illicit connections and discharges to the municipal storm drain system is necessary for the protection of the Town of Maynard water bodies and groundwater, and to safeguard the public health, safety, welfare and the environment.

(c) The objectives of this by-law are:

(1) to prevent pollutants from entering the Town of Maynard municipal separate storm sewer system (MS4);
(2) to prohibit illicit connections and unauthorized discharges to the MS4;
(3) to require the removal of all such illicit connections;
(4) to comply with state and federal statutes and regulations relating to stormwater discharges; and
(5) to establish the legal authority to ensure compliance with the provisions of this by-law through inspection, monitoring, and enforcement.

Section 2: Definitions

(a) For the purposes of this by-law, the following shall mean:

(1) AUTHORIZED ENFORCEMENT AGENCY: The Department of Public Works (hereafter DPW), its employees or agents designated to enforce this by-law.
(2) BEST MANAGEMENT PRACTICE (BMP): An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.
(3) CLEAN WATER ACT: The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) as hereafter amended.
(4) DISCHARGE OF POLLUTANTS: The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.
(5) GROUNDWATER: Water beneath the surface of the ground.
(6) ILLICIT CONNECTION: A surface or subsurface drain or conveyance, which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water and

any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this by-law.

(7) ILLICIT DISCHARGE: Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted in Section 8. The term does not include a discharge in compliance with an NPDES Storm Water Discharge Permit or a Surface Water Discharge Permit, or resulting from fire fighting activities exempted pursuant to Section 8, (a), of this by-law.

(8) IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water infiltrating the underlying soil. Impervious surface includes without limitation roads, paved parking lots, sidewalks, and rooftops.

(9) MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town of Maynard.

(10) NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER DISCHARGE PERMIT: A permit issued by United States Environmental Protection Agency or jointly with the State that authorizes the discharge of pollutants to waters of the United States.

(11) NON-STORMWATER DISCHARGE: Discharge to the municipal storm drain system not composed entirely of stormwater.

(12) PERSON: An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

(13) POLLUTANT: Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the Commonwealth. Pollutants shall include without limitation:

(A) paints, varnishes, and solvents;
(B) oil and other automotive fluids;
(C) non-hazardous liquid and solid wastes and yard wastes;
(D) refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnances, accumulations and floatables;
(E) pesticides, herbicides, and fertilizers;
(F) hazardous materials and wastes; sewage, fecal coliform and pathogens;
(G) dissolved and particulate metals;
(H) animal wastes;
(I) rock, sand, salt, soils;
(J) construction wastes and residues; and

(K) any noxious or offensive matter of any kind.

(14) PROCESS WASTEWATER: Water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

(15) RECHARGE: The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

(16) STORMWATER: Storm water runoff, snow melt runoff, and surface water runoff and drainage.

(17) SURFACE WATER DISCHARGE PERMIT. A permit issued by the Department of Environmental Protection (DEP) pursuant to 314 CMR 3.00 that authorizes the discharge of pollutants to waters of the Commonwealth of Massachusetts.

(18) TOXIC OR HAZARDOUS MATERIAL or WASTE: Any material, which because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as Toxic or Hazardous under G.L. Ch.21C and Ch.21E, and the regulations at 310 CMR 30.000 and 310 CMR 40.0000.

(19) WATERCOURSE: A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

(20) WATERS OF THE COMMONWEALTH: All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, costal waters, and groundwater.

(21) WASTEWATER: Any sanitary waste, sludge, or septic tank or cesspool overflow, and water that during manufacturing, cleaning or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct or waste product.

Section 3: Applicability

(a) This by-law shall apply to flows entering the municipally owned storm drainage system.

Section 4: Authority

(a) This bylaw is adopted under the authority granted by the Home Rule Amendment of the Massachusetts Constitution and the Home Rule Procedures Act, and pursuant to the regulations of the federal Clean Water Act found at 40 CFR 122.34.

Section 5: Responsibility for Administration

(a) DPW shall administer, implement and enforce this by-law. Any powers

granted to or duties imposed upon DPW may be delegated in writing by the DPW to employees or agents of DPW.

Section 6: Regulations

(a) DPW may promulgate rules and regulations to effectuate the purposes of this by-Law. Failure by the DPW to promulgate such rules and regulations shall not have the effect of suspending or invalidating this by-law.

Section 7: Prohibited Activities

(a) Illicit Discharges. No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the municipal separate storm sewer system (MS4), into a watercourse, or into the waters of the Commonwealth.

(b) Illicit Connections. No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm drain system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

(c) Obstruction of Municipal Storm Drain System. No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drain system without prior written approval from DPW.

Section 8: Exemptions

(a) Discharge or flow resulting from fire fighting activities.

(b) The following non-stormwater discharges or flows are exempt from the prohibition of non-stormwaters provided that the source is not a significant contributor of a pollutant to the municipal storm drain system:

(1) Waterline flushing;
(2) Flow from potable water sources;
(3) Springs;
(4) Natural flow from riparian habitats and wetlands;
(5) Diverted stream flow;
(6) Rising groundwater;
(7) Uncontaminated groundwater infiltration as defined in 40 CFR 35.2005(20), or uncontaminated pumped groundwater;
(8) Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air conditioning condensation;
(9) Discharge from landscape irrigation or lawn watering;
(10) Water from individual residential car washing;
(11) Discharge from dechlorinated swimming pool water (less than one ppm chlorine) provided the water is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance;
(12) Discharge from street sweeping;
(13) Dye testing done by the Board of Health or their designee or with prior consent of the DPW prior to the time of the test;
(14) Non-stormwater discharge permitted under an NPDES permit or a Surface

Water Discharge Permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and

(15) Discharge for which advanced written approval is received from the DPW as necessary to protect public health, safety, welfare or the environment.

Section 9: Emergency Suspension of Storm Drainage System Access

(a) DPW may suspend municipal storm drain system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to the public health, safety, welfare or the environment. In the event any person fails to comply with an emergency suspension order, DPW or the Board of Health may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

Section 10: Notification of Spills

(a) Notwithstanding other requirements of local, state or federal law, as soon as a person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of or suspects a release of materials at that facility or operation resulting in or which may result in discharge of pollutants to the municipal drainage system or waters of the Commonwealth, the person shall take all necessary steps to ensure containment, and cleanup of the release. In the event of a release of oil or hazardous materials, the person shall immediately notify the municipal fire and police departments and the DPW. In the event of a release of non-hazardous material, the reporting person shall notify the DPW no later than the next business day. The reporting person shall provide to the DPW written confirmation of all telephone, facsimile or in-person notifications within three business days thereafter. If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken, to prevent its recurrence. Such records shall be retained for at least three years.

Section 11: Enforcement

(a) DPW or an authorized agent of DPW shall enforce this by-law, regulations, orders, violation notices, and enforcement orders, and may pursue all civil and criminal remedies for such violations.

(b) Civil Relief. If a person violates the provisions of this by-law, regulations, permit, notice, or order issued thereunder, the DPW may seek injunctive relief in a court of competent jurisdiction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

(c) Orders. DPW or an authorized agent of DPW may issue a written order to enforce

the provisions of this by-law or the regulations thereunder, which may include:

(1) elimination of illicit connections or discharges to the MS4;
(2) performance of monitoring, analyses, and reporting;
(3) that unlawful discharges, practices, or operations shall cease and desist; and
(4) remediation of contamination in connection therewith.

(d) If the enforcing person determines that abatement or remediation of contamination is required, the order shall set forth a deadline by which such abatement or remediation must be completed. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the Town of Maynard may, at its option, undertake such work, and expenses thereof shall be charged to the violator.

(e) Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner will be notified of the costs incurred by the Town of Maynard, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with DPW within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of DPW affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Ch. 59,57 after the thirty-first day at which the costs first become due.

(f) Criminal Penalty. Any person who violates any provision of this by-law, regulation, order or permit issued thereunder, shall be punished by a fine of not more than $ 300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

(g) Non-Criminal Disposition. As an alternative to criminal prosecution or civil action, the Town of Maynard may elect to utilize the non-criminal disposition procedure set forth in G.L. Ch. 40, §21D and Ch. XXV, §5 of the Town of Maynard General Bylaw, in which case the DPW and the town administrator shall be the enforcing authority. The penalty for the 1st violation shall be a written warning and/or $100. The penalty for the 2nd violation' shall be $200. The penalty for the 3rd and subsequent violations shall be $300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

(h) Entry to Perform Duties Under this By-Law. To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the DPW, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this by-law and regulations and may make or cause to be made such examinations, surveys or sampling as DPW deems reasonably necessary.

(i) Appeals. The decisions or orders of DPW shall be final. Further relief shall be to a court of competent jurisdiction.

(j) The remedies listed in this by-law are not exclusive of any other remedies available under any applicable federal, state or local law.

Section 12: Severability

(a) The provisions of this by-law are hereby declared to be severable. If any provision, paragraph, sentence, or clause, of this by-law or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this by-law.

Section 13: Transitional Provisions

(a) Residential property owners shall have 180 days from the effective date of the by-law to comply with its provisions provided good cause is shown for the failure to comply with the by-law during that period.

Appendix B

Field Forms, Sample Bottle Labels, and Chain of Custody Forms

Maynard Sample Bottle Label

Maynard Water Quality Sampling Program Sample

Sample ID:_____

Laboratory Analysis: _____

Preservative: (pre-populated by lab)_____

Date:_____

Time:_____

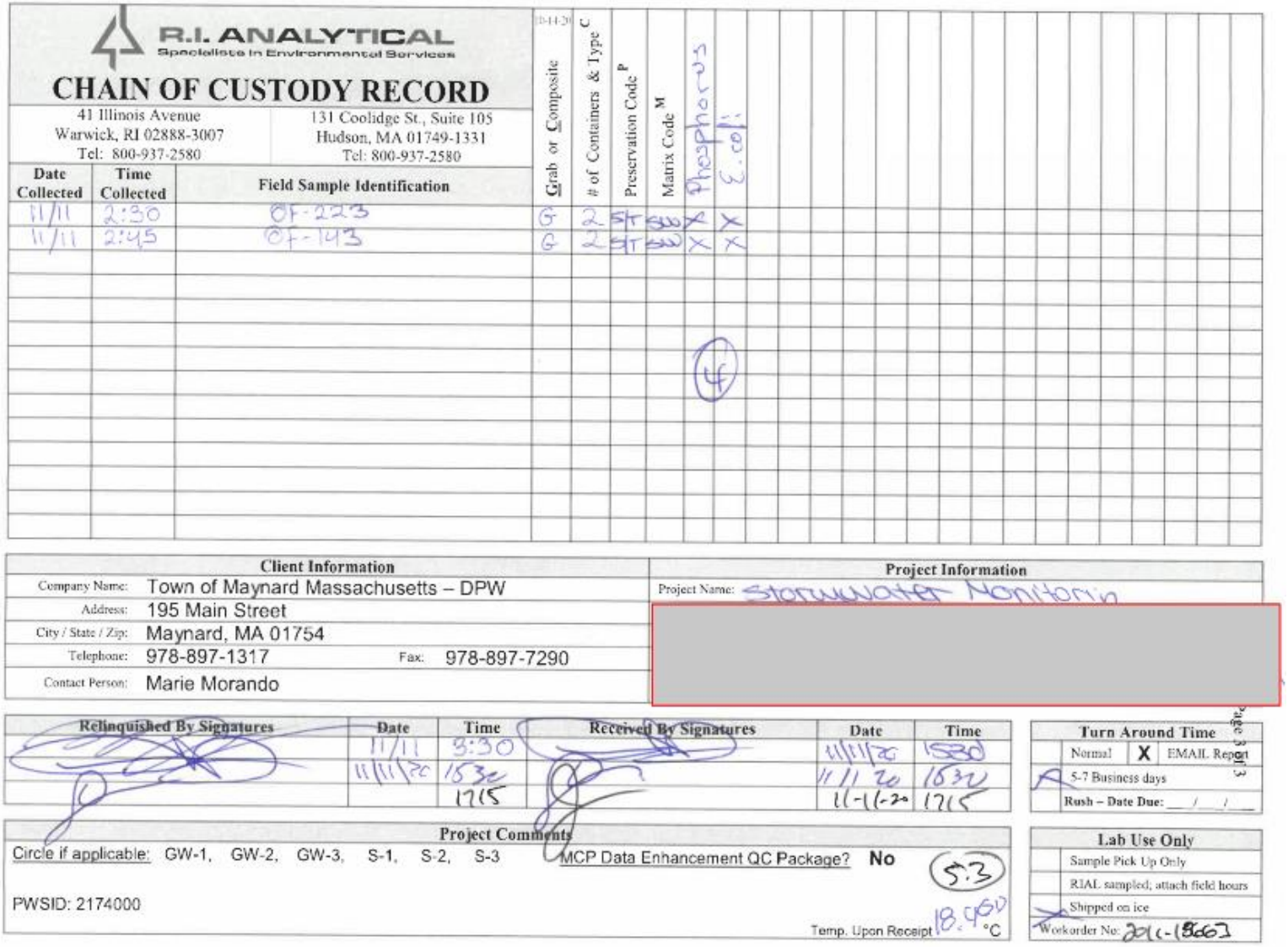
Collected By: _____

Bottle Type: _____(pre-populated by lab)_____

Maynard Sample Inspection Form

IDDE Outfall Screening Form	
Date of Inspection:	Date of Last Storm:
Inspector Name:	
Type of Inspection: ☐ Dry Weather ☐ Wet Weather	
Structure Found: ☐ Yes ☐ No	
Next upstream structure visited? ☐ Yes ☐ No	
Outfall Condition:	
Outfall Condition: ☐ Good: Inspect Within 2 Years ☐ Fair: Inspect Within 1 Year ☐ Failing: Requires Immediate Action ☐ Poor: Requires Maintenance ☐ Unknown	
Sedimentation: ☐ No Sedimentation ☐ Slight Sedimentation ☐ High Sedimentation	
IDDE Class: ☐ Potential ☐ Obvious ☐ Unlikely	
Reason for Illicit Suspicion:	
Visual Inspection:	
Staining: ☐ No Staining ☐ Some Staining ☐ Significant Staining	
Scour Protection Condition: ☐ Good: Inspect Within 2 Years ☐ Fair: Inspect Within 1 Year ☐ Failing: Requires Immediate Action ☐ Poor: Requires Maintenance ☐ Unknown	
Needs Repair? ☐ Yes ☐ No	Needs Cleaning? ☐ Yes ☐ No
Vegetative Growth: ☐ None ☐ < 25% Vegetated ☐ < 50% Vegetated ☐ 50% Vegetated ☐ > 50% Vegetated ☐ 100% Vegetated	
Flow: ☐ Yes ☐ No	Flow Volume: ☐ Low ☐ Moderate ☐ Heavy
Flow Clarity: ☐ Clear ☐ Cloudy ☐ Opaque	
Color of Flow: ☐ N/A ☐ Clear ☐ Tea/Coffee ☐ Clear Black ☐ Orange-Red ☐ Tan to Light Brown ☐ Milky/Dirty Dishwater Gray ☐ Milky White ☐ White Crusty Deposits ☐ Greenish-Bluish ☐ Blue ☐ Purple ☐ Dark Red ☐ Other (describe in notes)	
Floatables: ☐ Yes ☐ No	Sewage, Sheens & Scum: ☐ Yes ☐ No
Visual evidence of sewage?: ☐ Yes ☐ No	
Odor: ☐ None ☐ Rotten Eggs/Hydrogen Sulfide ☐ Musty Odor ☐ Sharp, Pungent Odor ☐ Sweet, Fruit ☐ Gasoline, Petroleum ☐ Chlorine ☐ Other (describe in notes)	
Water Quality Sampling	
Temperature (deg C):	Conductivity (micro-Siemens/cm):
pH:	Salinity (ppm):
Ammonia (mg/L):	Chlorine (mg/L):
Surfactants (mg/L):	
Additional Parameters Screened:	
Sample for Lab Collected: ☐ Yes ☐ No	
Lab Sample 1 Test:	Lab Sample 1 Results:
Lab Sample 2 Test:	Lab Sample 2 Results:
Lab Sample 3 Test:	Lab Sample 3 Results:
Notes:	

Maynard Example Chain of Custody Form from R.I. Analytical



R.I. ANALYTICAL
Specialists in Environmental Services

CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
Tel: 800-937-2580

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
Tel: 800-937-2580

Date Collected	Time Collected	Field Sample Identification	Grab or Composite	# of Containers & Type C	Preservation Code P	Matrix Code M	Phosphorus	3 coli
11/11	2:30	OF-223	G	2	5T	SW	X	X
11/11	2:45	OF-143	G	2	5T	SW	X	X

(4)

Client Information

Company Name: Town of Maynard Massachusetts – DPW
Address: 195 Main Street
City / State / Zip: Maynard, MA 01754
Telephone: 978-897-1317 Fax: 978-897-7290
Contact Person: Marie Morando

Project Information

Project Name: Stormwater Monitorin

Relinquished By Signatures	Date	Time	Received By Signatures	Date	Time
	11/11	3:30		11/11/20	1530
	11/11/20	1532		11/11 20	1632
		1715		11-11-20	1715

Turn Around Time

Normal X EMAIL Report
5-7 Business days
Rush – Date Due: ___/___/___

Project Comments

Circle if applicable: GW-1, GW-2, GW-3, S-1, S-2, S-3 MCP Data Enhancement QC Package? No

(5.3)

PWSID: 2174000

Temp. Upon Receipt 18.4°C

Lab Use Only

Sample Pick Up Only
RIAL sampled; attach field hours
Shipped on ice
Workorder No: 201-18603

Appendix C

Water Quality Analysis Instructions, User's Manuals and Standard Operating Procedures

Surfactants (Detergents) CHEMetrics™ K-9400 User Manual

Detergents CHEMets Kit

K-9400/R-9400: 0 - 3 ppm

Test Procedure

1. Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip breaking tool (fig. 1).
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube (fig. 1).
4. Cap the reaction tube and shake it vigorously for **30 seconds**. Allow the tube to stand undisturbed for **1 minute**.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube (fig. 2). The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMet ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMet ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

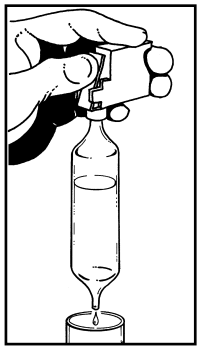


Figure 1

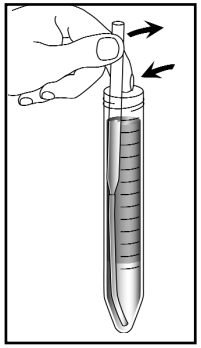


Figure 2

9. Obtain a test result by placing the ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found (fig. 3).

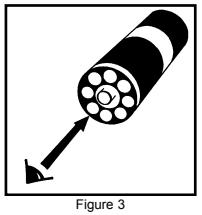


Figure 3

Tip Breaker

The tip breaker opens for easy disposal of the glass tips (pull lever away from body of tip breaker or pull open the side wall). The tip breaker will work most effectively if the tips are emptied out frequently.

Test Method

The Detergents CHEMets®[1] test kit employs the methylene blue extraction method[2,3,4]. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in ppm (mg/Liter) linear alkylbenzene sulfonate (equivalent weight 325).

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 22nd ed., Method 5540 C - 2000
3. EPA Methods for Chemical Analysis of Water and Wastes, Method 425.1 (1983)
4. ASTM D 2330-02, Methylene Blue Active Substances

Safety Information

Read SDS (available at www.chemetrics.com) before performing this test procedure. Wear safety glasses and protective gloves.

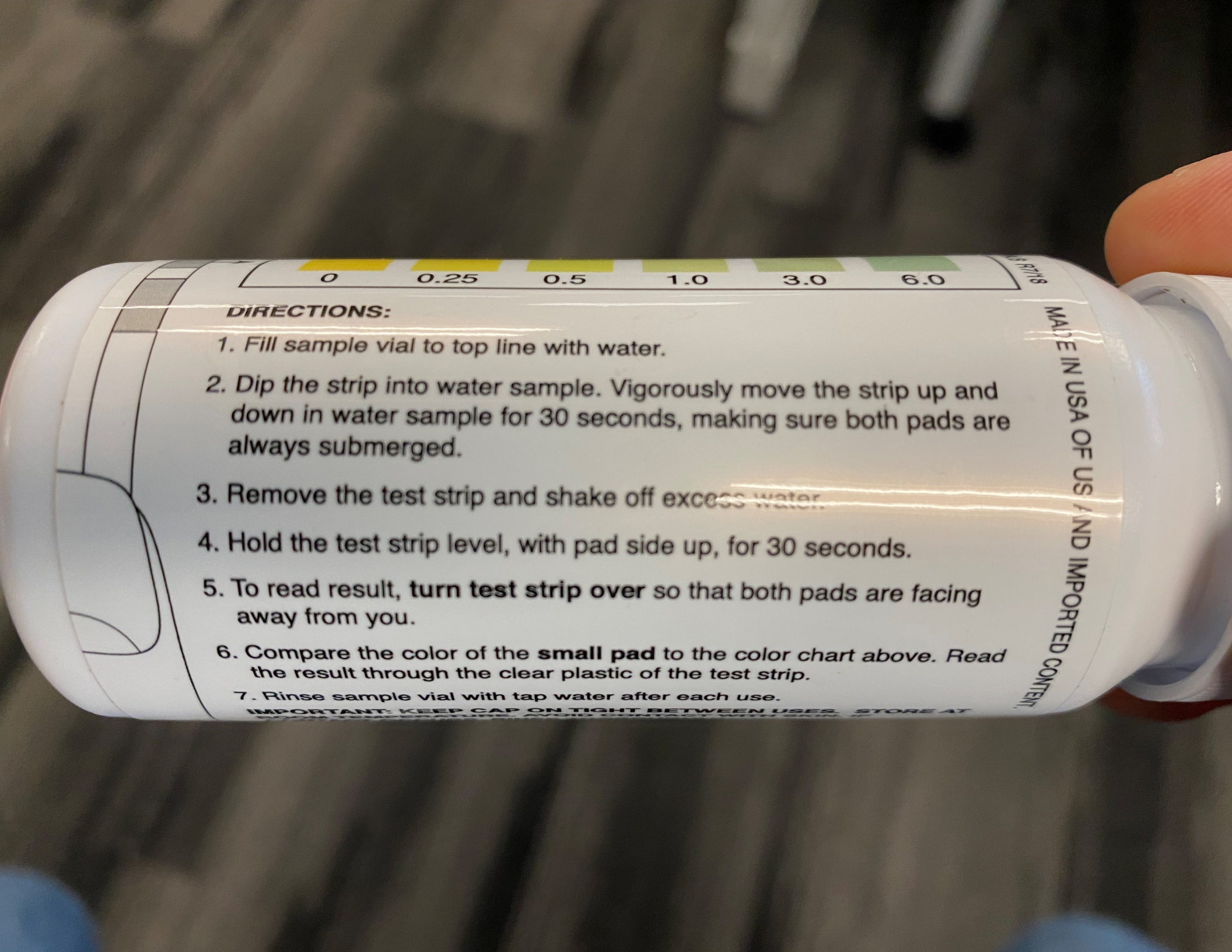
CHEMetrics

Simplicity in Water Analysis

www.chemetrics.com
4295 Catlett Road, Midland, VA 22728 U.S.A.
Phone: (800) 356-3072; Fax: (540) 788-4856
E-Mail: orders@chemetrics.com

Feb. 18, Rev. 10

HACH™ Ammonia Test Strips User Instructions


0
0.25
0.5
1.0
3.0
6.0
DIRECTIONS:
1. Fill sample vial to top line with water.
2. Dip the strip into water sample. Vigorously move the strip up and down in water sample for 30 seconds, making sure both pads are always submerged.
3. Remove the test strip and shake off excess water.
4. Hold the test strip level, with pad side up, for 30 seconds.
5. To read result, turn test strip over so that both pads are facing away from you.
6. Compare the color of the small pad to the color chart above. Read the result through the clear plastic of the test strip.
7. Rinse sample vial with tap water after each use.
IMPORTANT: KEEP CAP ON TIGHT BETWEEN USES. STORE AT
MADE IN USA OF US AND IMPORTED CONTENT

Hach™ DR300 Pocket Colorimeter™ II User Manual

DOC022.97.90639

DR300

10/2019, Edition 3

User Manual
Manual del usuario
Manuel de l'utilisateur
Manual do Usuário
用户手册
使用手冊
取扱説明書
사용 설명서
คู่มือผู้ใช้

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Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Dimensions (W x H x D)	6.9 x 15.7 x 3.4 cm (2.7 x 6.2 x 1.3 in.)
Enclosure	IP67, waterproof at 1 m (3.3 ft) for 30 minutes when battery compartment is closed and locked.
Light source	Light emitting diode (LED)
Detector	Silicon photodiode
Display	LCD with backlight
Weight	0.25 kg (0.55 lb)
Power requirements	4 AAA batteries; approximate life of 5000 tests (use of backlight decreases this number) Rechargeable batteries are not recommended.
Operating environment	0 to 50 °C (32 to 122 °F), 0 to 90% relative humidity non-condensing
Storage temperature	–20 to 55 °C (–4 to 131 °F), 0 to 80% relative humidity non-condensing
Wavelength	Fixed wavelength ±2 nm, different for each model
Filter bandwidth	15 nm
Absorbance range	0 to 2.5 Abs
Sample cell	25 mm (10 mL) and 1 cm (10 mL)
Data storage	Last 50 measurements

Specification	Details
Bluetooth® [1]	Bluetooth® is on when the optional Hach Communication Dongle is installed.
Certifications	CE
Warranty	1 year (EU: 2 years)

Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

[1] The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by HACH is under license.

2.1.1 Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.1.3 Certification

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class B:

Supporting test records reside with the manufacturer.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe B répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "B" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Move the equipment away from the device receiving the interference.
2. Reposition the receiving antenna for the device receiving the interference.
3. Try combinations of the above.

2.2 Product overview

This instrument is a portable filter photometer used for testing water.

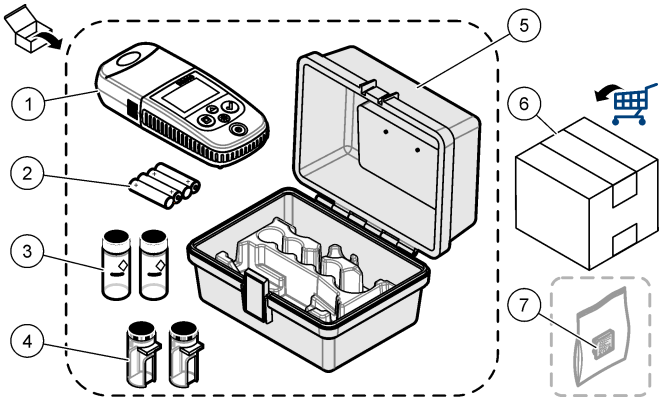
Note: *This instrument has not been evaluated to measure chlorine and chloramines in medical applications in the United States.*

2.3 Product components

Make sure that all components have been received. Refer to Figure 1. If any items are missing or damaged, contact the manufacturer or a

sales representative immediately. Figure 1 is an example and shows the parts supplied with LPV445.99.00110. Other instruments come with different components.

Figure 1 Product components



1 DR300	**5** Storage case
2 AAA alkaline batteries	**6** Reagents
3 Sample cells, 25 mm (10 mL), glass	**7** Hach Communication Dongle (optional, supplied separately)
4 Sample cells, 1 cm (10 mL), plastic	

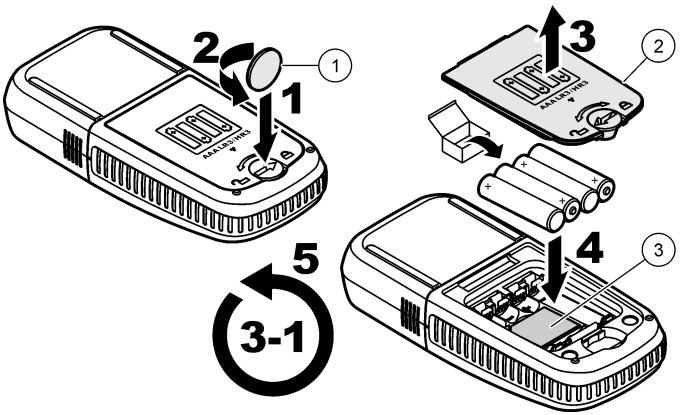
Section 3 Install the batteries

⚠ WARNING

Explosion hazard. Incorrect battery installation can cause the release of explosive gases. Be sure that the batteries are of the same approved chemical type and are inserted in the correct orientation. Do not mix new and used batteries.

Refer to Figure 2 to install the batteries. Then, push ⏻ to set the instrument to on.

Figure 2 Install the batteries



1 Coin	**3** Plastic insert for dongle[2]
2 Battery cover	

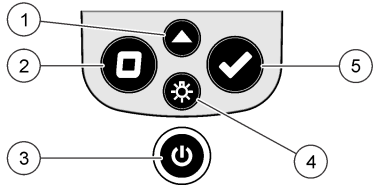
Section 4 User interface and navigation

4.1 Keypad description

Figure 3 shows the keypad and gives the key functions.

[2] Only remove the plastic insert to install the Hach Communication Dongle. Refer to the installation instructions supplied with the dongle.

Figure 3 Keypad

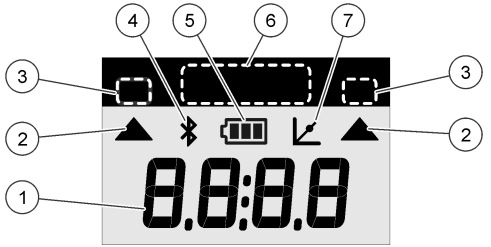


1 Range key: Selects the measurement range (e.g., LR or HR). Push and hold for 3 seconds to enter or exit menu mode. In menu mode, scrolls up or increases the value of the selected digit.	**4 Backlight key:** Sets the backlight to on and off. In menu mode, scrolls down or decreases the value of the selected digit.
2 Zero key: Sets the zero value before a measurement. In menu mode, goes back one menu level or moves the cursor to the previous digit.	**5 Read key:** Starts a sample measurement. In menu mode, selects the menu option shown or moves the cursor to the next digit.
3 Power key: Sets the power to on and off. Push and hold for 5 seconds to reset the instrument. The calibration is not deleted.	

4.2 Display description

Figure 4 shows the values and icons shown on the display.

Figure 4 Display



1 **Numeric display:** Measured value or menu options	**5** **Battery icon:** Battery power level. Flashes when the battery power level is low.
2 **Range icon:** Points to the selected measurement range	**6** Parameter and measurement ranges
3 Measurement ranges or parameters	**7** **Calibration adjusted icon:** The factory default calibration was adjusted or a user-entered calibration curve was entered.
4 **Bluetooth® icon:** Bluetooth® is on[3].	

Section 5 Set the time

Set the time (24-hour format).

1. Push and hold ▲ for 3 seconds to enter menu mode.
   The time shows (or 00:00).
2. Push ✔ to set the time.
3. Push the ▲ or ☼ to change the number that flashes. Push ✔ to go to the next digit. Push ◘ to go to the previous digit.

[3] Shows when the Hach Communication Dongle is installed.

Section 6 Do a test

⚠ DANGER

Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

⚠ DANGER

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

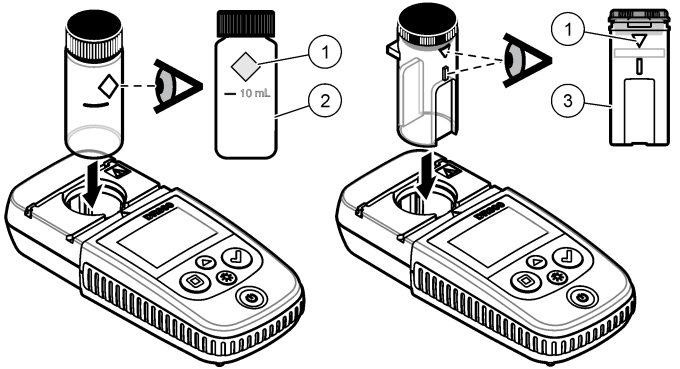
The generic steps to do a test follow.

To do a test for a specific parameter (e.g., chlorine), download the test procedure from the manufacturer's website. Refer to Download a test procedure on page 14.

1. Push ▲ to select the applicable measurement range (e.g., LR or HR).
2. Prepare the blank. Refer to the test procedure.
3. Clean the sample cell with a no-lint cloth.
4. Insert the blank sample cell into the cell holder. Make sure to install the blank sample cell in the correct and consistent orientation so that the results are more repeatable and precise. Refer to Figure 5.
5. Install the instrument cap over the cell holder. Refer to Figure 6.
6. Push ▢ to set the instrument zero.

7. Remove the blank sample cell.
8. Prepare the sample. Refer to the test procedure.
9. Clean the sample cell with a no-lint cloth.
10. Insert the sample cell into the cell holder. Make sure to install the sample cell in the correct and consistent orientation so that the results are more repeatable and precise. Refer to Figure 5.
11. Install the instrument cap over the cell holder. Refer to Figure 6.
12. Push ✔. The display shows the results in concentration units or absorbance.
    Note: *The result flashes if the result is less or more than the instrument range.*
13. Remove the sample cell from the cell holder.
14. Immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water (or distilled water).
    Note: *As an alternative, use tap water to rinse the sample cell if the samples measured have a higher concentration than the tap water.*

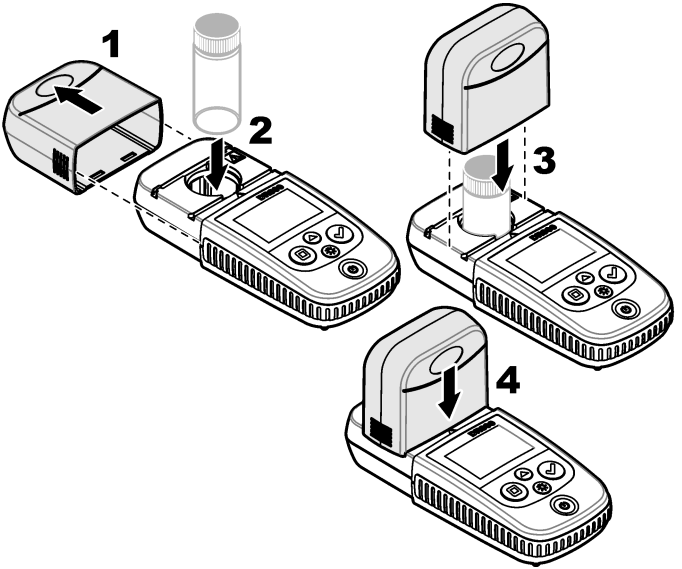
Figure 5 Sample cell orientation



1 Orientation mark[4]	**2** Sample cell, 25-mm (10 mL), glass[5]	**3** Sample cell, 1-cm (10 mL), plastic[6]

[4] Some variants of the instrument have sample cells without an orientation mark.
[5] Use the glass sample cell for low-range chlorine tests.
[6] Use the plastic sample cell for high-range chlorine tests.

Figure 6 Install the instrument cap over the cell holder



6.1 Download a test procedure

1. Go to http://www.hach.com.
2. Enter "DR300" in the Search box.
3. Select the applicable instrument from the list.
4. Click the Downloads tab.
5. Scroll down to "Methods/Procedures".
6. Click the link for the applicable test procedure to download it.

Section 7 Show measurements

Note: *The instrument saves a maximum of 50 measurements. After 50 measurements are done, new measurements replace the oldest measurements.*

1. Push and hold ▲ for 3 seconds.
2. Push ▲ until "rCL" (recall) shows, then push ✔.

   "– 01 –" shows. Measurement 01 is the last measurement done.
3. Push ✔ to scroll forward.

   The measurement number is followed by the measurement value and then the time.
4. To go to a measurement number, push ✔ until a measurement number shows, then push ▲ or ☼.

   Note: *Measurements cannot be deleted.*
5. Push and hold ▲ for 3 seconds to go back to measurement mode.

Section 8 Calibration

This instrument is calibrated at the factory. No user calibration is necessary.

8.1 Standard calibration adjust

Use the standard calibration adjust (SCA) option when a calibration must be adjusted to meet regulatory requirements. The factory calibration is adjusted slightly with the standard calibration adjust (SCA) option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are slight variations in the reagents or instruments.

Note: *For instruments with factory-calibrated ranges or methods, the standard calibration adjust (SCA) feature is disabled when a user-entered calibration is entered into the instrument. To set SCA back to on, set the instrument to the factory default calibration. Refer to* Set to the factory default calibration on page 20.

8.1.1 Do a standard calibration adjust

1. Complete the test procedure for the range to calibrate. For the sample, use the standard solution concentration given in the test procedure documentation.

   Note: *If a standard solution concentration is not given in the test procedure documentation, a different known standard can be used.*
2. When the test procedure is completed, push and hold ▲ for 3 seconds.
3. Push ▲ until “SCA” shows, then push ✔.

   The display shows the standard calibration adjust value.
4. If a different known standard is used, enter the value of the standard:

   a. Push ▲ until "Edit" shows, then push ✔.
   b. Enter the value of the standard.

      Push the ▲ or ☼ to change the number that flashes. Push ✔ to go to the next digit. Push ☐ to go to the previous digit.
5. Push ✔ to add the standard calibration adjust value to the factory calibration curve.

8.1.2 Set the standard calibration adjust to off

To use the factory default calibration again, set standard calibration adjust (SCA) to off.

1. Push and hold ▲ for 3 seconds to enter menu mode.
2. Push ▲ until "SCA" shows, then push ✔.
3. Push ▲ until "OFF" shows, then push ✔.

Note: *To set the SCA function to on again, do a standard calibration adjust.*

8.2 User-entered calibration curve

This instrument accepts a user-prepared calibration curve. The calibration curve can be from 0 to 2.5 absorbance. Make sure that the calibration curve includes standard values that are less and more than the range of interest.

The instrument range will be the same as the calibration range. For example, when the standards that are used are 1.00, 2.00 and 4.00. The instrument range is 1.00 to 4.00.

There are two options to enter a user calibration curve:

- **Enter a calibration curve with standards**—The standard solution values are entered with the keypad and the absorbance values are measured.
- **Enter a calibration curve with the keypad**—The standard solution values and absorbance values are entered with the keypad.

Note: *If the instrument is set to off or the instrument power is removed before a user-entered calibration curve is completed, the calibration curve is not saved. The instrument automatically switches off in user-entered calibration entry mode after 60 minutes of no activity. User-entered calibrations are completed when the user goes out of calibration (cal) mode or edit mode.*

8.2.1 Enter a calibration curve with standards

⚠ WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

Note: *As an alternative, deionized water can be used for the blank unless the sample is significantly more turbid or has more color than deionized water.*

1. Push ▲ to set the instrument to the range to calibrate (e.g., LR or HR).
2. Prepare the blank. Refer to the test procedure.
3. Clean the sample cell with a no-lint cloth.
4. Set the instrument to zero.
   a. Insert the blank sample cell in the cell holder.
   b. Install the instrument cap over the cell holder.

c. Push ▢. The display shows "- - - -", then "0.00".

5. Push and hold ▲ for 3 seconds to enter menu mode.
6. Push ▲ until "USEr" shows, then push ✔.
7. Push ▲ until "CAL" shows, then push ✔.
8. When "S0" shows on the display, push ✔.
9. Enter 00.00 (or 000.0) for the blank value.

   Push the ▲ or ☼ to change the number that flashes. Push ✔ to go to the next digit. Push ▢ to go to the previous digit.
10. When "A0" shows on the display, push ✔ to measure the absorbance of the blank.

    The display shows the absorbance value for "S0".
11. Remove the sample cell from the cell holder.
12. Prepare the sample. Refer to the test procedure. For the sample, use the standard solution concentration given in the test procedure documentation.
13. Clean the sample cell with a no-lint cloth.
14. Push ☼ to show "S1" (or "Add"), then push ✔.
15. Enter the concentration value of the first calibration standard, then push ✔.
16. When "A1" shows on the display, do the steps that follow to measure the absorbance:

    a. Insert the reacted standard sample cell in the cell holder.
    b. Install the instrument cap over the cell holder.
    c. Push ✔. The display shows the absorbance value for "S1".
17. The calibration is completed with two calibration points. If additional standards are necessary for calibration:

    Do steps 11 – 16 again to measure more calibration standards.
18. Remove the sample cell from the cell holder.

19. Immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water (or distilled water).

    Note: *As an alternative, tap water can be used to rinse the sample cell if the concentration of the parameter in the tap water is less than the samples measured.*

20. Push and hold ▲ for 3 seconds to go back to measurement mode.

8.2.2 Enter a calibration curve with the keypad

At least two data pairs are necessary to enter a user-prepared calibration curve. A concentration value and the absorbance value for the given concentration is necessary for each data pair. A maximum of 10 data pairs can be entered.

1. Push ▲ to set the instrument to the range to calibrate (e.g., LR or HR).
2. Push and hold ▲ for 3 seconds to enter menu mode.
3. Push ▲ until "USEr" shows, then push ✔.
4. Push ▲ until "Edit" shows, then push ✔.
5. When "S0" shows on the display, push ✔.
6. Enter the first data pair.

   The first data pair is S0 (concentration value) and A0 (absorbance value).

   - Push ▲ or ☼ to change the number that flashes.
   - Push ✔ to go to the next digit.
   - Push ◘ to go to the previous digit.
7. Do steps 5 and 6 again to enter the second data pair (S1 and A1).
8. The calibration is completed with two data pairs. If additional data pairs are necessary for calibration:

   a. When “Add” shows, push ✔.
   b. Do steps 5 and 6 again to enter more data pairs.
9. Push and hold ▲ for 3 seconds to go back to measurement mode.

8.2.3 Set to the factory default calibration

To remove a user-entered calibration curve from the instrument and use the factory calibration, do the steps that follow:

1. Push and hold ▲ for 3 seconds to enter menu mode.
2. Push ▲ until "USEr" shows, then push ✔.
3. Push ▲ until "dFL" (default) shows, then push ✔.

Section 9 Maintenance

⚠ CAUTION

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

NOTICE

Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.

9.1 Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry as necessary.

9.2 Clean the sample cells

⚠ CAUTION

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

Most laboratory detergents are used at recommended concentrations. Neutral detergents, such as Liquinox, are safer to use when regular

cleaning is necessary. To decrease the cleaning times, increase the temperature or use an ultrasonic bath. To complete the cleaning, rinse a few times with deionized water and then let the sample cell air dry. Sample cells may also be cleaned with acid, followed by a thorough rinse with deionized water.

Note: *Always use acid to clean sample cells that were used for low-level metal tests.*

Special cleaning methods are necessary for individual procedures. When a brush is used to clean sample cells, take extra care to avoid scratches on the interior surfaces of the sample cells.

9.3 Replace the batteries

Replace the batteries when the battery power level is low. Refer to Install the batteries on page 7.

Section 10 Troubleshooting

Error	Description	Solution
E-00	No Zero	In user calibration mode, a standard solution was measured before the instrument zero was set. Measure a blank solution to set the instrument to zero.
E-01	Ambient light error[7]	There is ambient light in the cell holder. Make sure that the instrument cap is fully installed on the cell holder. Refer to Do a test on page 11.
E-02	LED error[7]	The LED (light source) is out of regulation. Replace the batteries. Make sure that the LED in the cell holder comes on when ✔ or ☐ is pushed.

[7] When an E-01 or E-02 error occurs on a measurement, the display shows "_.__". The decimal place depends on the chemistry. If the E-01 or E-02 error occurs while the instrument is set to zero, set the instrument to zero again.

Error	Description	Solution
E-03	Standard adjust error	• The measured value of the standard solution is more than the adjustment limits. Prepare a fresh standard. • The standard solution is not within the concentration range that can be used for standard calibration adjust. Prepare a standard with a value at or near the recommended concentrations given in the procedure. • Make sure that the concentration of the standard solution is entered correctly.
Reading flashes followed by E-04	The reading is more or less than the instrument range.[8]	If the reading is less than the instrument range, make sure that the instrument cap is fully installed on the cell holder. Measure a blank. If the blank reading is not zero, set the instrument to zero again.
		If the reading is more than the instrument range, identify if there is a light blockage in the cell holder. Dilute the sample. Do the test again.
E-06	Absorbance error	The absorbance value is not correct or the user-entered calibration curve has fewer than two points. Enter or measure the absorbance value again.
E-07	Standard value error	The standard solution concentration is equal to another standard solution concentration that is already entered in the user-entered calibration curve. Enter the correct standard concentration.
E-09	Flash error	The instrument is not able to save data. Push and hold ⏻ for 5 seconds to reset the instrument.
E-10	Environment temperature too high or too low	The ambient temperature is out of range. Use the instrument only in the specified operating conditions. Refer to Specifications on page 3.

[8] The value that flashes will be 10% over the upper test range limit.

Error	Description	Solution
E-12	Low battery power	Battery power is too low. Replace the batteries. Refer to Install the batteries on page 7.
E-13	Parameter load failure	The memory of the instrument is defective. Contact technical support.
E-14 followed by "_.__" or "0" if no zero was present	Zero measurement invalid	The zero measurement is too low. Use a sample cell filled with water and try again. If the error continues, contact technical support.
E-15 followed by "_.__"	Absorbance too high	Identify if there is a light blockage in the cell holder. Clean the cell holder. Dilute the sample. Do the test again. ***Note:*** *This instrument can not read absorbance values higher than 3.5 Abs.*
E-20	Signal measurement out of range	There is too much light on the light detector. Make sure that the instrument cap is fully installed on the cell holder. Do the test again. If the error continues, contact technical support.
E-21	Signal measurement unstable	There is an unstable signal on the light detector. There is too much or unstable ambient light. Make sure that the instrument cap is fully installed on the cell holder. Do the test again. If the error continues, contact technical support.
E-22	Hardware error	The electronic system is defective. Contact technical support.

The following errors can occur immediately after an instrument update.

Error	Description	Solution
E-30	No application	There was an error during the application update. A valid application was not found on the instrument. Update the instrument again.
E31	Bootloader update failed	There was an error during the transmission of the bootloader update. Update the bootloader again.

Error	Description	Solution
E-32	Application update failed	There was an error during the transmission of the application update. Update the instrument again.
E-66	Update failed	The instrument is defective. Contact technical support.

Section 11 Replacement parts and accessories

⚠ WARNING

Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Replacement parts

Description	Quantity	Item no.
AAA batteries, alkaline	4/pkg	4674300
Instrument cap	1	LPZ445.99.00006
Battery cover	1	LPZ445.99.00007
Sample cell, 25 mm (10 mL), glass	6/pkg	2427606
Sample cell, 1 cm (10 mL), plastic	2/pkg	4864302

Accessories

Description	Quantity	Item no.
Hach Communication Dongle	1	LPV446.99.00012
Soft-sided case/holster	1	5953100

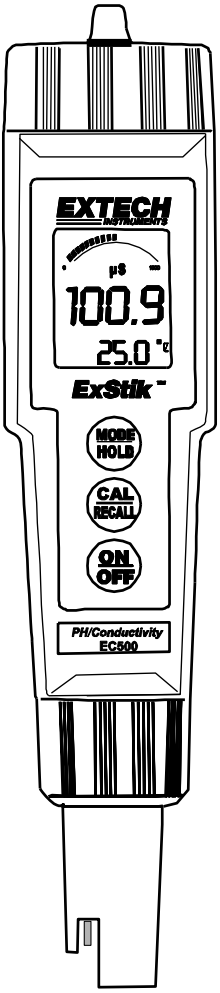
EXTECH ExStik™ EC 500 User Manual

EXTECH®

User Manual

ExStik® EC500

pH / Conductivity / TDS / Salinity / Temperature Meter



CE

Additional User Manual Translations available at www.extech.com

Introduction

Congratulations on your purchase of the ExStik® EC500 pH/Conductivity/Total Dissolved Solids (TDS) / Salinity meter. With the EC500's dynamic cell-constant technology it is possible to measure a wide range of Conductivity, TDS, and Salinity with the same electrode. Careful use and maintenance will provide years of reliable service.

Powering the ExStik™

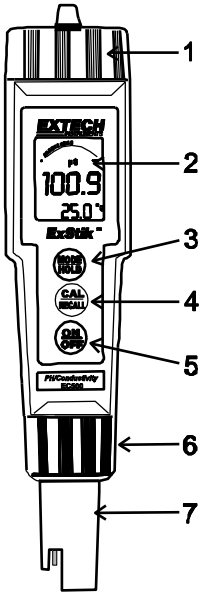
The ExStik® uses four (4) CR2032 Lithium Ion Batteries (included). If the batteries are weak, the 'BAT' indicator appears on the LCD. Press the ON/OFF key to turn the ExStik® on or off. The auto power off feature shuts the ExStik® off automatically after 10 minutes of inactivity to preserve battery life.

Getting Started

- Remove the cap from the bottom of the ExStik to expose the pH electrode, reference junction and conductivity electrodes.
- Before the first use or after storage, soak the electrode in tap water or pH 4 buffer solution for about 10 minutes.
- White KCL crystals may be present in the cap or on the electrode. This is to be expected depending on the length of time in storage. These crystals will dissolve while soaking the electrode or they can be rinsed away with tap water.
- For best results calibrate with pH 7 buffer solution first, then calibrate with the buffer solution closest to the expected pH value of the solution or material to be tested.
- To preserve the pH electrode life, keep the sponge in the protective cap soaked with tap water or pH 4 buffer solution.
- For best results, calibrate for conductivity with a standard in the expected range of the sample. For maximum accuracy calibrate from low conductivity value standards to high value standards.

Meter Description

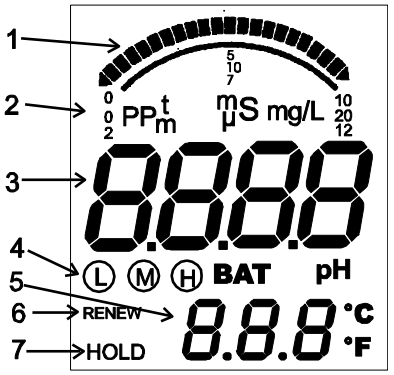
Front Panel Description



1. Battery compartment cover
2. LCD Display
3. MODE/HOLD button
4. CAL/RECALL button
5. ON/OFF button
6. Electrode Collar
7. pH/Conductivity Electrode

(Note: The Electrode cap is not shown)

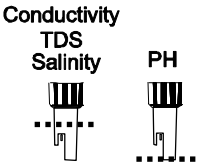
LCD Display



1. Bargraph display
2. Measurement units
3. Main display
4. Range calibration and low battery indicators
5. Temperature display
6. Renew indicator
7. Reading hold indicator

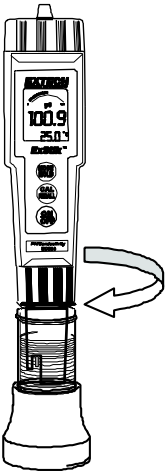
Measurement Procedure

Sample Preparation:

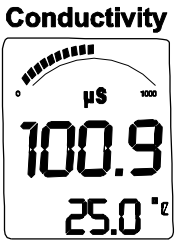


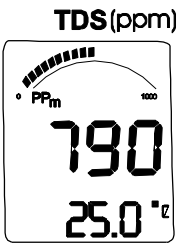
1. For Conductivity, TDS or Salinity place the test sample in a sample cup with enough depth (2.5cm minimum) to cover the electrode. Stir the solution to remove any air bubbles.
2. For pH, place the tip of the electrode in the sample or make contact with a wet surface.

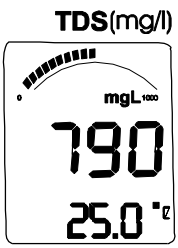
Measurement:

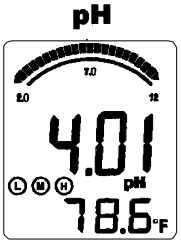


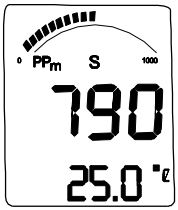
1. Press the **ON** button. (8888 and then "SELF CAL" will appear in the display during the turn-on diagnostics)
2. Depress and hold the **MODE/HOLD** key to scroll to the desired measurement mode.
3. Insert the electrode into the sample making sure that the electrodes are completely submersed.
4. Slowly stir the solution with the electrode to remove air bubbles if in the Conductivity, TDS or Salinity mode.
5. If in the Conductivity, TDS or Salinity modes, the meter will auto-range to the proper range and then display the reading.











Changing Measurement Function

The meter can be set to measure pH, Conductivity, TDS or Salinity.
To change the mode:

1. Press and Hold the **MODE/HOLD** button for 2 seconds and the display will begin to scroll through the units.

   µS (Conductivity); **pH**; **ppm S** (Salinity); **ppm** (TDS); **mg/l** (TDS);

Note: The "HOLD" function cannot be on when changing the measurement function. If "HOLD" is displayed in the lower left corner of the display, briefly press the **MODE/HOLD** button to turn it off.

2. When the desired units are displayed, release the **MODE/HOLD** button.

TDS Compensation Ratio

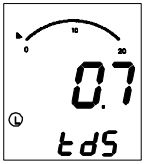
The TDS value is determined by multiplying a conductivity reading by a known ratio factor. The meter allows for selecting a conversion ratio in the range of 0.4 to 1.0. The ratio varies with the application, but is typically set between 0.5 and 0.7.

Note: The stored ratio will briefly appear in the lower temperature display when the meter is first turned on, or when changing measurement function to TDS.

Note: In the Salinity mode the ratio is 0.4 to 0.6 auto

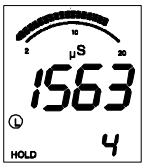
To change the ratio, while in the TDS measurement mode (ppm or mg/l):

1. Press and release the **CAL/RECALL** button twice in succession. The stored ratio will appear in the display.
2. Press the **MODE/HOLD** button to increase the ratio value in steps of 0.1.
3. When the desired ratio is displayed, press and release the **CAL/RECALL** button to store the value and return to the normal mode.
4. If no buttons are pressed for 5 seconds, the meter returns to measure mode.



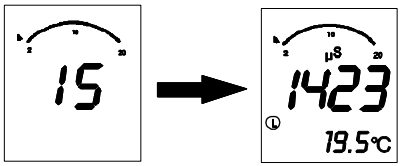
Storing Readings

1. Press the **MODE/HOLD** button to store a reading. The storage location number will be displayed on the lower display, while the main display shows the stored reading. The meter will enter the HOLD mode and the "HOLD" indicator will appear.
2. Press the **MODE/HOLD** button again to exit the HOLD mode and return to normal operation.
3. If more than 25 readings are stored, previously stored readings (starting with number 1) will be overwritten.



Recalling Stored Readings

1. Press the **CAL/RECALL** button and then press the **MODE/HOLD** button. A location number (1 through 25) will briefly appear and then the value stored in that location will appear. The displayed units will flash, indicating that the storage recall mode is active.



2. The last stored reading will be displayed first. Pressing and releasing the **MODE/HOLD** button will scroll through the stored readings one at a time. The location number is displayed first, followed by the reading stored in that location.
3. To exit the storage mode, press the **CAL/RECALL** button and the meter will return to normal operation, after displaying "End".

Clear Stored Memory

With the unit on, press and hold ON/OFF for 4 seconds. "**clr**" will be briefly displayed when the memory is cleared.

Changing Temperature Units

To change the displayed temperature units (°C or °F):

1. With the unit OFF, press and hold down the **CAL/RECALL** button.
2. With the **CAL/RECALL** button depressed momentarily press the **ON/OFF** button. When "SELF CAL" appears in the display release the **CAL/RECALL** button. The unit will power on with temperature displayed in the new units.

Data Hold Mode

Press the **MODE/HOLD** button to hold (freeze) a reading in the display. The meter will enter the HOLD mode and the "HOLD" indicator will appear.

Note: This also stores the reading.

Press the **MODE/HOLD** button again to return to normal operation.

Auto Power OFF

The auto power off feature automatically shuts the meter off 10 minutes after the most recent button press.

Auto Power OFF Disable

To disable the Auto Power Off feature:

1. Turn the unit on
2. Press **CAL/RECALL** once (**Quickly**)
3. Immediately and simultaneously press the **MODE/HOLD** and **ON/OFF** buttons for approximately 2 seconds, until "**oFF**" is briefly displayed

To disengage this feature, turn the unit off with the **ON/OFF** button. The next time the unit is powered up, Auto Power OFF mode will be engaged again.

Low Battery Indication

When the batteries become weak the "BAT" icon will appear in the display. Refer to the Maintenance section for battery replacement information.

Calibration - pH (1, 2, or 3 points)

1. Place the electrode into a buffer solution (4, 7, or 10). Press and hold the **CAL/RECALL** key until “CAL” appears in the lower (temp.) display. When doing a 2 or 3 point calibration, calibrate with pH 7 buffer first, then follow with pH 4 then the pH 10 buffer.
2. The ExStik® automatically recognizes the solution and calibrates itself to that value (the circled number on the LCD will match the solution). Note that if the solution is more than 1 pH unit off from the L (4), M (7), or H (10) pH buffer, or if the electrode slope is low, the ExStik® will assume an error and abort the calibration (‘End’ will be displayed, and the unit will return to measure mode.)
3. During calibration, the pH reading flashes on the main display.
4. When calibration is complete, the ExStik® automatically displays “SA”, then “End” and returns to normal operation mode.
5. The appropriate circled indicator (L, M, or H) appears on the LCD when a particular calibration or series of calibrations has been completed within one power on cycle. When the ExStik® is turned off, the circled indicator configuration and the calibration data will be retained.
6. For a two or three-point calibration, repeat steps 1-4.
7. See **Reset Calibration Data** to clear all calibration data from the meter.

CAL Reminder Display

When in pH measurement mode, a “CAL” icon will appear after 15 on/off cycles of the meter without performing a calibration. The CAL display is simply a reminder to calibrate pH, and will turn off when the pH electrode is recalibrated. The reminder does not affect function in any way.

RENEW Display

A flashing ‘RENEW’ warning indicates that the probe is not performing to expected specifications. If cleaning and recalibration does not cause the RENEW icon to disappear, replace the probe (see optional accessories on the last page of this manual). The RENEW display appears as a result of the pH electrode slope falling below 70% of a nominal slope.

Measurement and Display Considerations

- If the unit appears to be locked (display frozen). It is possible that the Data Hold mode has been inadvertently accessed by pressing the **MODE/HOLD** button. (“HOLD” will be displayed in the bottom left of the LCD.) Simply press the **MODE/HOLD** button again or turn the meter off and then on.
- For maximum accuracy, allow sufficient time for the temperature of the probe to reach the temperature of the sample before calibrating. This will be indicated by a stable temperature reading on the display.

Reset Calibration Data

Follow this procedure to clear all calibration data from the meter. Resetting the calibration data may be necessary when new calibration solutions are used or accuracy of measurements is in question.

1. Turn off the meter.
2. Press and Hold the Cal/Recall and Mode/Hold buttons.
3. Momentarily press the On/Off button, as soon as the display comes on, release all 3 buttons.
4. The display will show “**dFLt rSt**” (default reset) and all of the calibration data will be erased. If “**dFLt rSt”** does not appear, retry the procedure.
5. Proceed to the calibration routine for pH and Conductivity.

Calibration - Conductivity

Meter accuracy verification should be performed on a periodic basis. Once per month is the recommended cycle for normal use. If calibration is required, a conductivity standardizing solution must be obtained. The meter can be calibrated in any or all of the three ranges. Standardizing solutions of 84µS/cm, 1413µS/cm or 12.88mS/cm (12,880µS/cm) are used for the automatic calibration recognition procedure. No other calibration values are permitted.

Calibration is always done in conductivity mode. Since salinity and TDS values are calculated from conductivity values, this procedure also calibrates the salinity and TDS ranges.

1. Fill a sample cup with the standardizing solution.
2. Turn the meter ON and insert the electrode into the solution. Tap or move the electrode in the sample to dislodge any air bubbles.
3. Press and hold the **CAL/RECALL** button (approximately 2 seconds) until "CAL" appears in the lower (temp) display. The main display will start flashing.
4. The meter will automatically recognize and calibrate to the standardizing solution. The display will briefly indicate "SA", End and then return to the measurement mode after a calibration. Note: The "SA" will not appear if the calibration fails.
5. The "range calibrated" symbol will appear in the display for each range that is calibrated during that power on cycle.
   - Ⓛ Low range, 84µS/cm
   - Ⓜ Medium range, 1413µS/cm
   - Ⓗ High range, 12.88mS/cm (12,880µS/cm)

Note: Each time the calibration mode is entered all calibration symbols on the display are cleared, but only the calibration data for the currently calibrated range is replaced. The other two ranges keep the existing calibration data, just the symbols are removed. Calibration of all three ranges must be performed during one power on period for all three range calibration symbols to appear.

See **Reset Calibration Data** to clear all calibration data from the meter.

Note: The meter allows for a 1, 2 or 3 point calibration. If calibration is done for more than one point the lowest value standard should be done first to obtain the best accuracy.

Considerations and Techniques

- Do not touch the inner surfaces of the conductivity electrodes. Touching the surface of the platinized electodes may damage and reduce the life of the probe.
- Store the electrode in the wetting cap with the sponge moistened with pH 4.01 buffer solution.
- Always rinse the electrode in de-ionized water between measurements to avoid cross contamination of the sample. Double rinsing is recommended when high accuracy is required.
- Periodically, accumulated salt deposits from the reference electrode may build up in the storage cap, and should be rinsed away. These deposits could affect measured values of low conductivity samples.
- When measuring low conductivity samples, extra care is recommended in rinsing the probe to avoid contamination of the sample with electrolyte from the pH reference electrode. This will only be a factor when measuring in the low range, and can be further minimized by increasing the volume of the sample. (Example: Try a 200 to 500 mL sample.)
- If the 20mL sample cup is to be used, then the electrode should not be allowed to sit in the sample for any longer than necessary, to avoid pH electrolyte leakage into the sample, raising the conductivity value.

Operational Matrix

Function / Resulting Action	***Power Status***	***Mode Setting***	***Required Key Press Sequence***
On/Off	On or Off	Any	Momentary press of the ON/OFF key
Calibration	On	pH or Conductivity	Press & hold CAL/RECALL key for 2 seconds, until it enters CAL function
Store Reading	On	Any measure mode	Momentary press of the MODE/HOLD key
Hold Release	On	While In Hold Mode	Momentary press of the MODE/HOLD key
Enter Memory Retrieval	On	Any measure mode	Momentary press of the CAL/RECALL key followed by a momentary press of the MODE/HOLD key (Within 4 seconds)
Scroll Stored Readings	On	Memory Recall	Momentary press of the MODE/HOLD key (Displays “last in first out”)
Exit Memory Retrieval	On	Memory Recall	Momentary press of the CAL/RECALL key
Clear Stored Memory	On	Any Measure Mode	Press and hold the ON/OFF key for 4 seconds, until “clr” is displayed.
Change Measurement Mode	On	Any	Press and hold the MODE/HOLD key for at least 2 seconds (the modes will scroll by until the key is released)
Enter Cond/TDS Ratio	On	TDS (ppm or mg/l)	Press and release the CAL/RECALL key twice in quick succession
Change Cond/TDS Ratio	On	TDS ratio	Momentary press of the MODE/HOLD key (each key press increases the ratio by 0.1, the value cycles from 0.4 - 1.0)
Exit Cond/TDS Ratio	On	TDS ratio	Momentary press of the CAL/RECALL key
Change Temperature Units	Off	n/a (off mode)	Press and hold the CAL/RECALL key then momentarily press the On/Off key. Release the CAL/RECALL key after the "SELF CAL" lights
Override Auto Power Off	On	Any measure mode	Momentarily press the CAL/RECALL key then simultaneously press and hold the ON/OFF & MODE/HOLD key for approximately 2 seconds, until “oFF” is displayed
Default Reset	OFF	n/a	Simultaneously press ON/OFF, CAL/RECALL and MODE/HOLD momentarily. “dFLt” will be displayed.

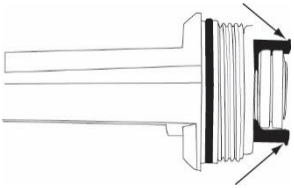
Specifications

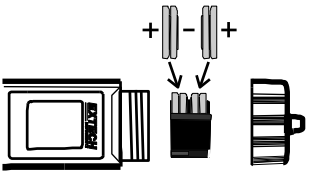
Display	2000 count LCD with Bargraph
pH Range	0.00 to 14.00
pH Accuracy	±0.01 pH typical
pH ATC Range	32°F to 194°F (0°C to 90°C)
pH Reference Junction	Permanent gel, non-refillable
Conductivity ranges	0 to 199.9µS 200 to 1999µS 2.00 to 19.99mS
TDS ranges	0 to 99.9ppm or mg/L
(Variable ratio)	100 to 999ppm or mg/L 1.00 to 9.99ppt or g/L
Salinity range	0 to 99.9ppm
	100 to 999ppm 1.00 to 9.99ppt
TDS Ratio	0.4 to 1.0 adjustable
Salinity Ratio	0.4 to 0.6 auto
Conductivity ATC	2.0% per °C
Conductivity ATC Range	32.0°F to 140°F (0.0°C to 60.0°C)
Temperature Range	23.0°F to 194°F (-5.0°C to 90.0°C)
Temperature Resolution	0.1 up to 99.9, 1 >100
Temperature Accuracy	±1.8°F; 1°C (from 23 to 122°F;-5 to 50°C)
	±5.4°F; 3°C (from122 to 194°F; 50 to 90°C)
Accuracy	Conductivity: ±2% full scale TDS: ±2% full scale Salinity: ±2% full scale
Measurement Memory	25 tagged (numbered) readings
Low battery indication	'BAT' appears on the LCD
Power	Four (4) CR2032 Lithium Ion Batteries
Auto power off	After 10 minutes (override available)
Operating conditions	23°F to 122°F (-5°C to 50°C)
Dimensions	1.6 x 7.9 x 1.6" (40 x 200 x 40 mm)
Weight	3.3 oz (93 g)

Maintenance

Battery Replacement

1. Twist off the battery compartment cap
2. Holding the battery housing in place with a finger, pull out the battery carrier using the two small tabs.
3. Replace the four (4) CR2032 batteries observing polarity.
4. Replace the battery compartment cap





Safety: Please dispose of batteries responsibly; never dispose of batteries in a fire, batteries may explode or leak. If the meter is not to be used for 60 days or more, remove the battery and store separately

Electrode Replacement

1. To remove an electrode, unscrew and completely remove the electrode collar (turn the collar counter-clockwise to remove).
2. Gently rock the electrode from side to side, pulling it downwards, until it disconnects from the meter.
3. To attach an electrode, carefully plug the electrode into the meter socket (note that the electrode connector is keyed, ensuring proper connection).
4. Tighten the electrode collar firmly enough to make a good seal (a rubber gasket seals the electrode with the meter).

Cleaning Recommendations

When cleaning the probe, take care not to scratch or damage the sensing surface or the platinized electrode surfaces.

Contaminant	***Cleaning Solution***	***Instructions***
Water soluble substances	Deionized water	Soak or scrub with a soft brush. Recondition in 4 or 7 buffer for 1 hour.
Grease & Oil	Warm water and household detergent	Soak or scrub with a soft brush, maximum of 10 minutes. Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.
Heavy grease & Oil	Alcohol	Maximum of 5 minute soak, scrub with a soft brush. Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.
Lime and hydroxide coatings	10% acetic acid	Soak until coating dissolved, maximum of 5 minutes. Rinse thoroughly with DI water, recondition in 4 or 7 buffer for 1 hour.

Please Note: Since the EC500 does not have a refillable pH reference electrolyte chamber, it is important not to soak the electrode in the above solutions for more than the recommended times. To do so may cause a reference potential shift, which will cause degradation in performance or failure.

Troubleshooting

Problem	***Possible Cause***	***Action***
Reading is frozen	Unit is in “HOLD” mode	Press MODE/HOLD key to exit “HOLD” mode
“BAT” message	Batteries are low	Replace batteries
Unit will not calibrate in pH	Low pH slope	Replace electrode, see reorder information
Unit will not calibrate in pH	Clogged or contaminated reference junction	Clean junction (see cleaning instructions)
Unit will not calibrate in pH	Damaged or worn out sensing membrane	Replace electrode, see reorder information
Unit will not calibrate in pH	Contaminated pH buffers	Use fresh buffers
Unit will not calibrate in conductivity mode	Contaminated conductivity standards	Use fresh standards
Unit will not calibrate in conductivity mode	Dirty probe	Clean conductivity probe (See cleaning instructions)
Unit will not calibrate in conductivity mode	Damaged conductivity probe	Replace electrode, see reorder information
Unit will not calibrate in conductivity mode	Trapped air bubbles	Tap or stir to release air bubbles
Unit will not turn on	Batteries are low or dead	Replace batteries
Unit will not turn on	Batteries installed with incorrect polarity	Replace batteries, observe polarity
“RENEW” message	pH sensor needs recalibration	Recalibrate unit Use fresh buffers
“RENEW” message	pH sensor slope has fallen below acceptable limits	Replace electrode, see reorder information
Unit will not respond to any key presses	Internal fault	Perform hard reboot: Remove batteries, hold ON/OFF switch down for 5 seconds, replace batteries

Two-year Warranty

FLIR Systems, Inc. warrants this Extech brand instrument *to be free of defects in parts and workmanship for* ***two years*** *from date of shipment (a six-month limited warranty applies to sensors and cables). To view the full warranty text please visit: http://www.extech.com/support/warranties.*

Calibration and Repair Services

FLIR Systems, Inc. offers calibration and repair services for the Extech brand products we sell. We offer NIST traceable calibration for most of our products. Contact us for information on calibration and repair availability, refer to the contact information below. Annual calibrations should be performed to verify meter performance and accuracy. Product specifications are subject to change without notice. Please visit our website for the most up-to-date product information: www.extech.com.

Contact Customer Support

Customer Support Telephone List: https://support.flir.com/contact

Calibration, Repair, and Returns: repair@extech.com

Technical Support: https://support.flir.com

Appendix D

IDDE Employee Training Record

PY1 Training Notes

Meeting Notes

Place: Maynard Police Department
Meeting Room
197 Main Street
Maynard, MA 01754

Date: December 18, 2018

Notes Taken by: Carley Przystac, Lori Kennedy

Project #: 12293.25

Re: MS4 Annual Compliance Training-Town of Maynard

ATTENDEES

VHB:	Town of Maynard:
Lori Kennedy, Water Resources	See attached sign-in sheet
Carley Przystac, Water Resources	
Wayne Amico, Maynard Town Engineer	

VHB held a Municipal Operations Stormwater Training for the Town of Maynard's Department of Public Works on December 18, 2018. The main topics covered in this session were:

- Stormwater 101: The Basics
- Water Quality Regulations
- Illicit Discharges
- Good housekeeping

Stormwater 101: The Basics

As part of this section, VHB reviewed what stormwater is, where Maynard's stormwater goes, and some common stormwater impacts. The Assabet River, which is right next to the highway garage, accepts most of the town's drainage and is impaired for phosphorous. The Assabet River is part of the Sudbury-Assabet-Concord (SuAsCo) watershed.

Water Quality Regulations

The Clean Water Act was the initial regulation that authorized the US EPA to regulate discharges of pollutants. Today, the MS4 permit regulates the discharges of towns, like Maynard, in Massachusetts. The MS4 permit applies to urbanized areas, which covers most of Maynard. There are six minimum control measures for the permit. Today, we focused on the two most pertinent to DPW: Illicit Discharge Detection and Elimination (IDDE) and Good Housekeeping.

Illicit Discharges

Illicit discharges are any discharge to an MS4 that is not composed entirely of stormwater or clean water. These discharges may occur through "dumping" practices or through illicit piped connections. Aaron Miklosko, Maynard's DPW director, expects his staff to talk to residents if staff observe them dumping into a storm drain. If residents give the staff member a difficult time or become confrontational, staff members should contact their supervisor or Aaron

directly. Maynard's DPW staff identified a significant issue with dog bag pollution by residents, especially near rail trail paths.

Good Housekeeping

Municipal activities that may impact water quality include: facilities management, parks, cemetery, and golf course management, vehicle and equipment storage and maintenance, construction, and winter road maintenance. Most of these will be addressed in a SWMP prepared by VHB for the Town. Immediate actions to promote good housekeeping practices are described below in the "action steps" section.

Action Steps:

- Joe will place dumpsters on concrete pad
- Tim and Joe will contact the contractor for solid waste removal to replace dumpsters that are broken or missing lids
- DPW will look into installing a silt fence around stockpiles in the DPW yard
- DPW will talk to their janitorial staff to make sure they do not dump floor machines outside
- Aaron is meeting with the operators of Maynard's golf course (Sterling Company) and will speak with them about their pesticide and fertilizer application practices. Since this is Town land, it must comply with the Town's MS4 program.
- Aaron will look into adding a roof for the fueling station and an oil/grit separator to the capital plan. Since the fire department fuels their trucks at the fueling station, roofs should be installed in a way that allows large trucks to maneuver.
- Aaron and Wayne will look into acquiring silt sacks for catch basins near active disturbance
- Aaron and Wayne to look into acquiring a rumble rack/gravel apron/stabilized construction entrance to reduce sediment on Summer Street
- DPW to investigate containment measures for snow storage areas
- DPW to investigate ownership of stormceptors identified by Joe
- DPW to inspect stormwater structures at the high school
- VHB to assist DPW in developing highway garage SWPPP

PY1 Sign-in Sheet (12/18/2018)

MAYNARD STORMWATER TRAINING

DECEMBER 18, 2018

Please Sign In

AARON MIKOSKO	
Charles Dismuke	
Joe Parker	
Tom Palola	
Marc Currier	
James P Ferguson	
Shawn Dickerson	
Nathan Dee	
Tim Goulding	

MAYNARD STORMWATER TRAINING

DECEMBER 18, 2018

Please Sign In

JOE FOSTER	
Mike Conroy	
Jim Mullaney	
Jacob Doughty	
Matt Tuomi	
Craig Gonsalves SR	
John DeMars	

PY2 Training Notes

Meeting Notes

Place: Maynard Police Department
Meeting Room
197 Main Street
Maynard, MA 01754

Date: January 7, 2020 Notes Taken by: Nate Pacheco, VHB

Project #: 12293.41 Re: Maynard DPW Stormwater Training

ATTENDEES

VHB:	Town of Maynard:
Lori Kennedy	Justin DeMarco, DPW Director
Nate Pacheco	Kaitlin Young, Conservation Agent
Wayne Amico	DPW staff (see attached sign-in sheet)

VHB held a Municipal Operations Stormwater Training for the Town of Maynard's Department of Public Works (DPW) on January 7, 2020. During this meeting, VHB reviewed stormwater basics, the Town's illicit discharge detection and elimination (IDDE) program, and pollution prevention best practices. VHB also asked Town staff members about their current operation and maintenance (O&M) practices, which VHB will incorporate into Maynard's written O&M procedures.

The following is a summary of the discussion. An asterisk (*) denotes material that Justin DeMarco, Maynard DPW Director, specifically asked VHB to include in an upcoming presentation to the Board of Selectmen.

WATERBODIES OF CONCERN

Maynard stormwater drains to Assabet River, streams, ponds, and upstream wetlands. Receiving waterbodies include:

- Assabet River
- Taylor Brook
- Second Division Brook
- Pratt's Brook
- Puffer's Pond
- Durants Pond (mentioned by Katie, Lori will check MS4 map)

STORMWATER POLLUTANTS

- Lori reviewed a list of common stormwater pollutants*
- DPW noted water chestnut and invasive species in Assabet River, specifically in area surrounding the municipal wastewater treatment plant
    - Treatment plant does not currently have tertiary denitrification processes
    - Municipalities upstream and downstream also discharge treated wastewater to the Assabet

101 Walnut Street
PO Box 9151
Watertown, MA 02472-4026
P 617.924.1770

ANIMAL WASTE

- Dog Waste:
    - DPW staff have observed residents dumping dog waste bags into catch basins; how do we address this?
        - Kaitlin/Justin suggest flyers, social media posts, door postings
        - Consider catching residents in the act at known spots and issuing warnings/fines as necessary
        - Consider applying for grant for "No dumping, drains to river" catch basin markers
            - Would want etched markers or ones that can be installed with epoxy lain over it
        - Justin to enforce penalties for catch basin dumping
- Geese:
    - DPW staff noted that geese congregate at the following locations:
        - Alumni Football Field by High School (fake dogs have been put up as deterrents)
        - Country Club/Golf Course (deterrents have been put in place)
        - Crow Park
        - Mill Pond
        - Field behind Town Hall/Police Station

SWIMMING POOLS

- Most residents do not know that they should dechlorinate their pools before draining to the MS4
    - Wayne suggests website/FB post and/or targeted outreach to residents with swimming pools

ILLICIT DISCHARGES

- Lori and DPW defined illicit discharges*
- Lori reviewed VHB's IDDE dry weather screening/sampling results*
- DPW noted discolored (orange) flow at the capped landfill at the solar field on Waltham Street
    - This solar field is on top of a landfill that was capped in the 1980s with clay
    - DPW staff are not aware of any recent inspections

  - Maynard does not think they have any as-built drawings or files on the capped dump site
  - VHB will prioritize sampling outfalls in that area
    - Kaitlin will search for Board of Health files/sampling records on this site, if any exist
- Discussion of what to do if DPW staff see illicit dumping/discharge in person
  - Approach the person if it doesn't seem like the conflict will escalate
  - Report the situation to Joe/Justin at DPW
  - Take a picture of the illicit discharging/dumping
- DPW suggests that VHB prioritize inspecting structures in the following areas:
  - Solar farm on Waltham Street
  - Sites where dog waste dumping has been observed (DPW to provide)
  - Catch basins where cleaning contractor notices flow (DPW to provide in the future, after new catch basin cleaning contract is in place)
  - Structures near septic systems (Kaitlin/DPW to provide)
    - DPW notes that only B Street, Field Street, and Lower Parker Street are not sewered
  - Areas DPW has received sewer/water calls about (DPW to assemble and provide)

GOOD HOUSEKEEPING

Facilities Management

- Dumpsters and Waste Management*
  - Contractor is responsible for making sure dumpsters have drains and functional lids
    - Contractor is currently B.L. Harvey
  - Maynard is responsible for making sure the lid and drain are closed
  - For private dumpsters, Katie has observed that people dump next to dumpsters and waste never makes it in
    - Maynard to consider an ordinance to enforce this; may be difficult due to limited staff

- Floor Drains
    - Should be connected to sewer system-not storm drains
- Janitorial Procedures
    - Maynard to consider training for janitorial crews to make sure they understand how to properly dispose of cleaning products and wastewater
- Painting
    - Use impermeable ground cloths, clean up spills immediately

Parks and Cemeteries

- Clean-Up and Maintenance
    - Maynard recently raised their trash sticker price (for "pay-as-you-throw" program) and is expecting more illicit dumping in parks and cemeteries
        - Need to be ready to respond to this and enforce ordinance preventing dumping
    - Maynard does not store de-icers in barrels outside in public areas
- Lawn Care
    - Maynard mows sports fields to 2-2.5-inch height
    - At other facilities, grass is allowed to grow longer in accordance with best management practices
    - Fowler Field may be an issue for clippings in runoff given proximity to nearby waterbody
- Fertilizer Use
    - State regulations prohibit fertilizer use within 20 feet of a waterbody and within Zone I wellhead protection area
    - Maynard will obtain O&M plans from the contractor who runs the Town-owned golf-course where fertilizer is potentially applied
        - Alternatively, Maynard can send the VHB O&M plan to the golf-course contractor if an O&M plan is not currently in place

- Pesticides
    - Maynard uses a licensed contractor for pesticide application
    - Maynard will obtain O&M plans from Town-owned golf-course where pesticides are potentially applied
        - Alternatively, Maynard can send the VHB O&M plan to the golf-course contractor if an O&M plan is not currently in place
- Leaf Litter/Grass Clippings
    - VHB noted dumping of leaf litter/grass clippings into two small ponds at the High School and behind the Town Hall Parking lot
        - Leaf litter should not be blown into or stored near waterbodies
    - Maynard will address the dumping and store clippings in designated areas moving forward
    - Compost facility is located in a wellhead Zone II protection area; DPW is planning to relocate compost facility or install containment measures

Vehicles and Equipment*

- Fueling Station*
    - Fueling stations should ideally be covered, if possible
    - Maynard currently has 2 buried tanks at the Highway Garage fueling station
- Spill Response
    - Clean all small fuel spills and leaks
    - Report spills and leaks immediately
- Washing
    - Vehicles should be washed inside when possible
    - Oil/grit separator should be installed for outside vehicle washing
        - At a minimum, wash in a location so that runoff will flow over a vegetated area before reaching the receiving waterbody or stormwater infrastructure
    - Limit undercarriage washing
    - Maynard currently sprays the undercarriage of all municipal vehicles with a fluid film to reduce the need for washing

- Storage/Maintenance
    - Inspect storage areas regularly
    - Never conduct maintenance near storm drains

Erosion and Sediment Control

- Materials*
    - Cover or contain stockpiles
        - Maynard to contain (with a silt fence) stockpiles at Pine Street
    - Maynard currently keeps gravel piles at the highway garage in concrete bins
    - Justin is working on a contract to have debris piles removed and disposed of
- Tracking
    - Maynard has stone and asphalt in place at the Summer Street leaf pile to prevent tracking
- Inlet Protection
    - Maynard does not currently have any silt sacks in their inventory
    - Silt sack removal is difficult. Improper removal causes sediment collected in the silt sack to end up in the sump
    - If street flooding occurs, DPW staff poke through silt sacks to allow more flow into catch basins
- Winter Road Maintenance
    - Maynard does not use sand, only salt
    - Maynard is not interested in purchasing a melter for snow pile removal
- Street Sweeping*
    - DPW sweeps all municipal roads and parking lots at least twice a year. DPW is interested in potentially obtaining a vacuum sweeper
        - Vacuum sweepers are better at removing fines and reducing phosphorus loading to waterbodies. They also can be used to maintain porous pavement.

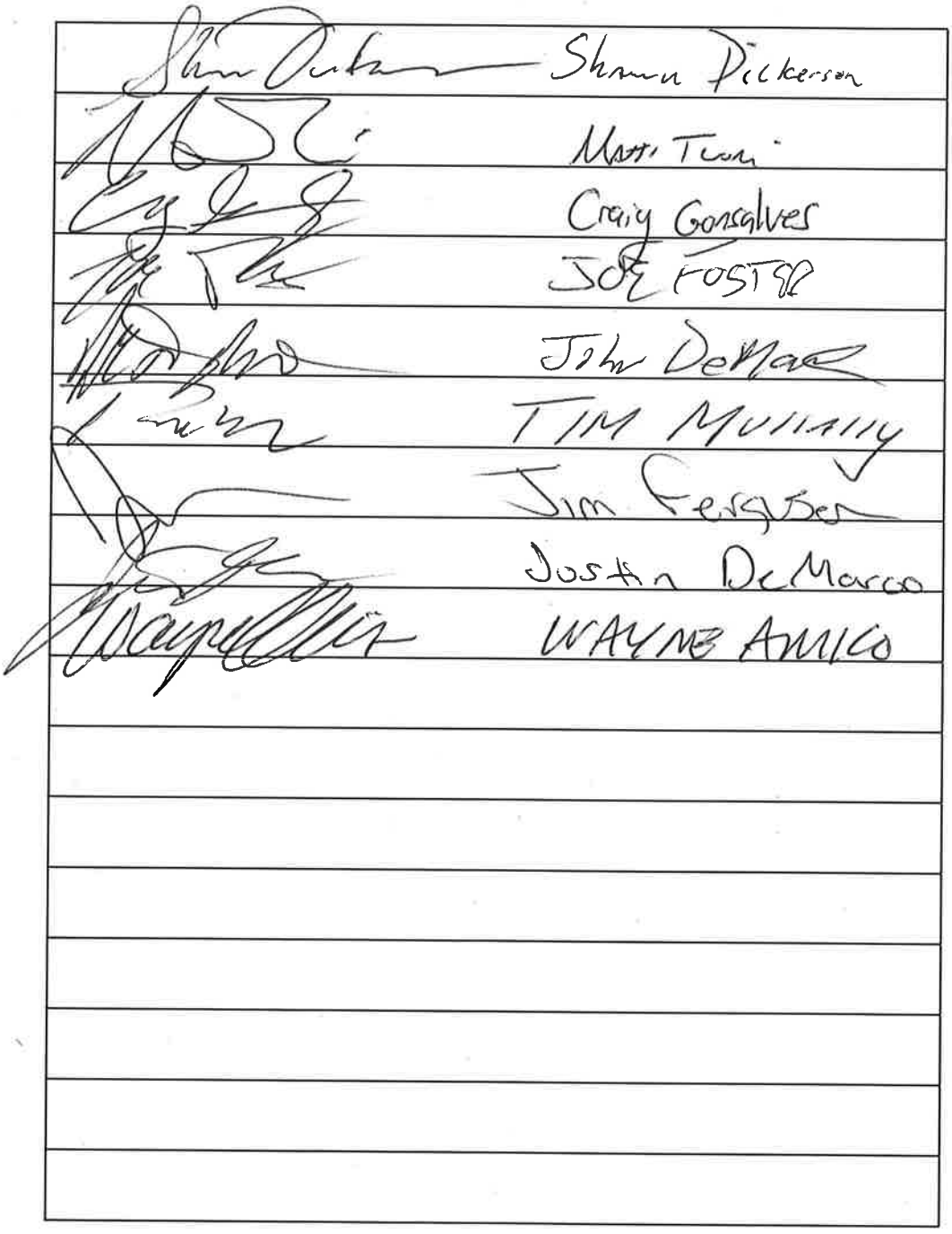
Inspection/Maintenance of stormwater treatment systems

- Yearly maintenance/inspection was conducted in 2019
- VHB is working on adding treatment systems to stormwater geodatabase for mapping

PY2 Sign-in Sheet (1/7/2020)

Maynard Municipal Operations
Stormwater Training
January 7, 2020

Please sign in below:

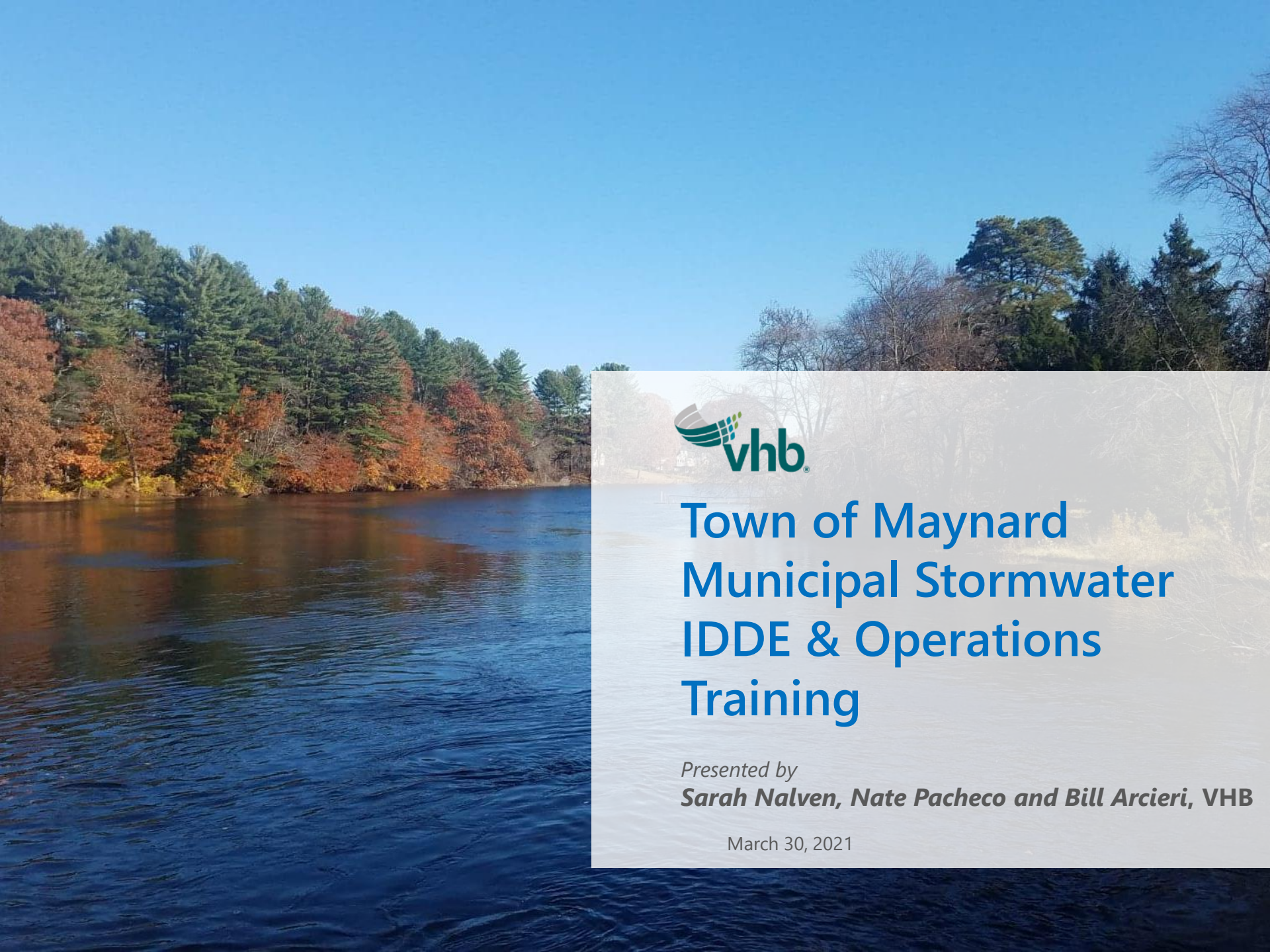


Maynard Municipal Operations
Stormwater Training
January 7, 2020

Please sign in below:

Kaitlin Young

PY3 Training Notes



Town of Maynard Municipal Stormwater IDDE & Operations Training

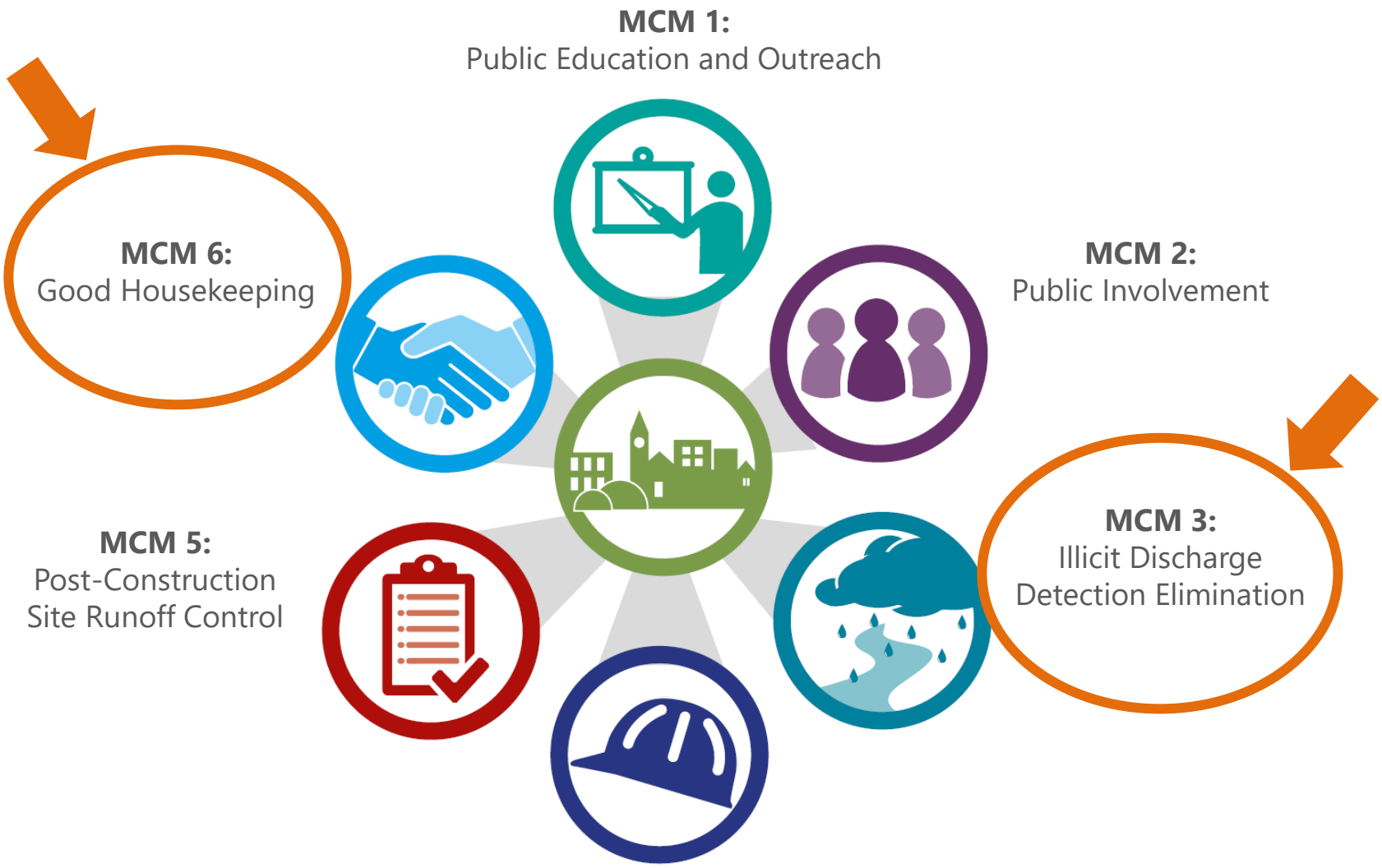
Presented by
***Sarah Nalven, Nate Pacheco and Bill Arcieri*, VHB**

March 30, 2021

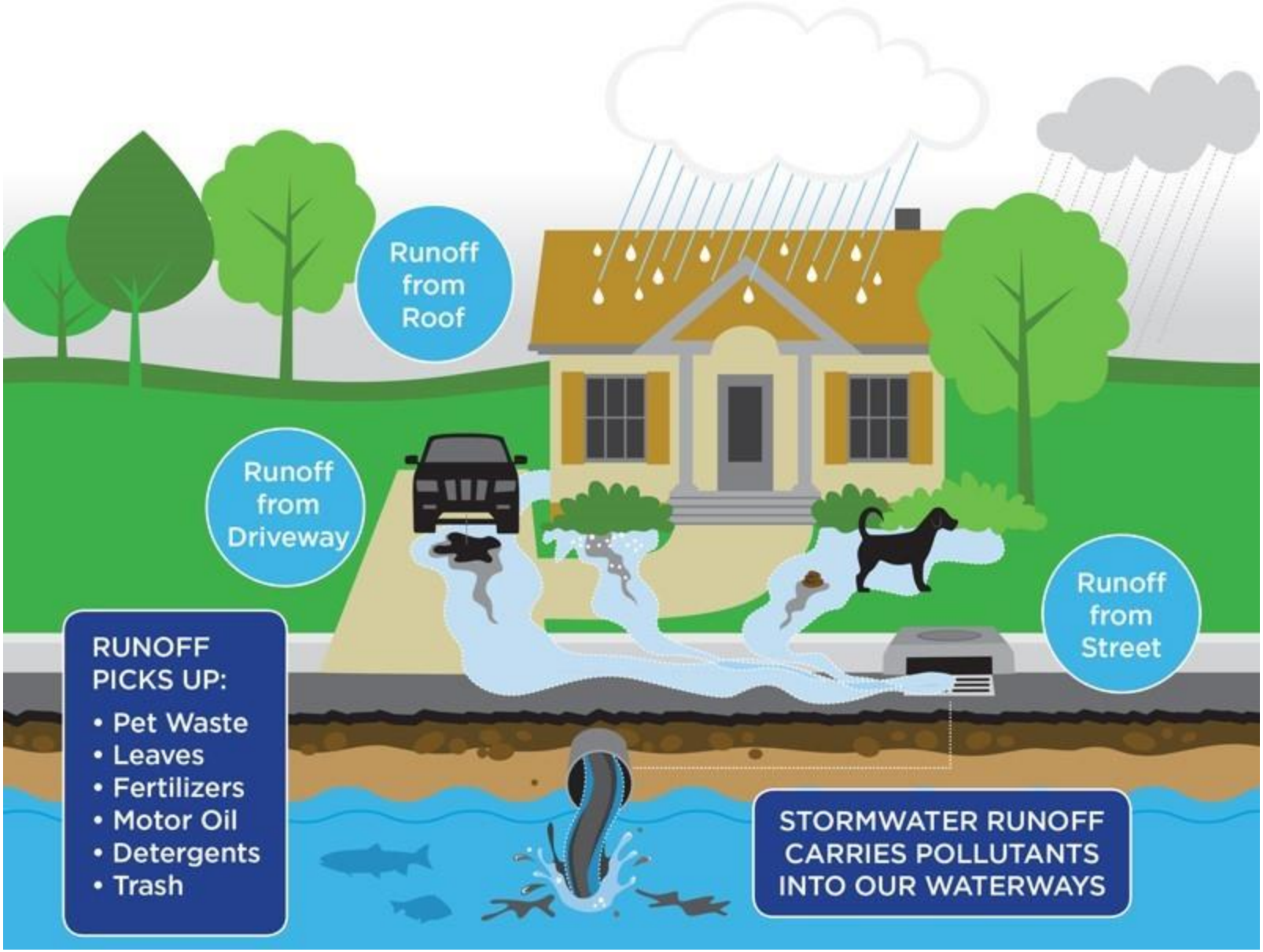
Why are we here today?

1. Refresh key aspects of Illicit Discharge Detection Elimination (IDDE)
2. Review & improve Good Housekeeping and O&M practices to keep pollutants out of our waterbodies
3. To comply with the MS4 Permit

Many Aspects of the MS4 Permit



Stormwater 101: The Basics

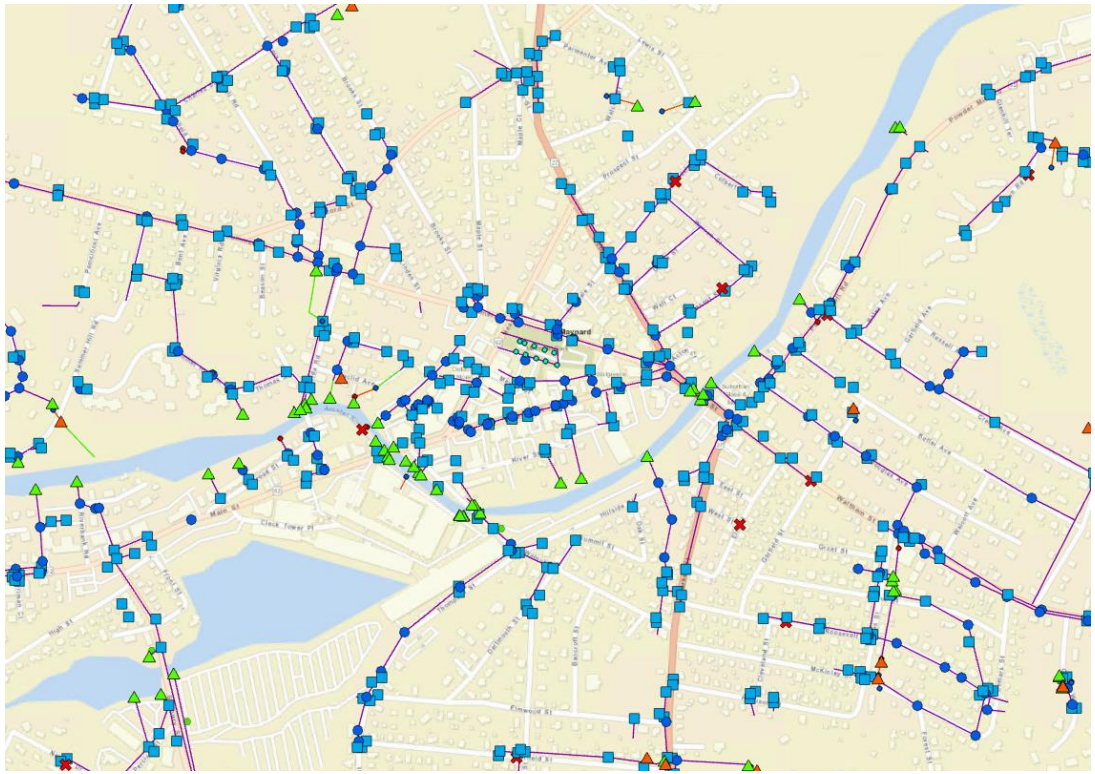

Runoff from Roof
Runoff from Driveway
Runoff from Street
RUNOFF PICKS UP:
• Pet Waste
• Leaves
• Fertilizers
• Motor Oil
• Detergents
• Trash
STORMWATER RUNOFF CARRIES POLLUTANTS INTO OUR WATERWAYS

Maynard's Drainage System
(Municipal Separate Storm Sewer System, or MS4)

- Catch Basins
- Stormwater treatment systems
- Drain Pipes and Manholes
- Swales
- Culverts
- Outfalls

Where does Maynard's stormwater go?

- Into MS4, then discharged to waterbody (Assabet)
- MS4 is mapped



Illicit Discharge Detection & Elimination

vhb®

What is an illicit discharge?

- Any discharge to an MS4 that is not composed entirely of stormwater or clean water
- Generally, if you see something other than **rainwater** or **snow melt…**

going down a storm drain,

coming out of an outfall,

or running through a ditch,

it's an illicit discharge.

Allowable Discharges

- Fire fighting water
- Water line flushing
- Irrigation water
- Diverted stream flows
- Uncontaminated groundwater
- Foundation drains
- Air conditioning condensate
- Sump pumps for clean groundwater
- Residential car washing
- Dechlorinated swimming pool discharges
- Street wash water

Sources of illicit discharges

- Illicit discharges enter the drainage system due to:
  - Cracked sanitary sewer pipe
  - Spills
  - Illegal dumping
  - Incorrect connection of sewer lateral to drainpipe
  - Outdoor cleaning/maintenance activities

Illicit Discharges—Things to Look For

"Dumpster juice"

Hoses directed into storm drains

Illicit Discharges—Things to Look For

Dry stains on storm drains, gutters, or outfalls.

Illicit Discharges—Things to Look For

Discharges with odd color or odor.

Yard waste in streets, ditches, or wetlands.

Illicit Discharges—Things to Look For

Sheens from oil or gasoline.

Turbid, sediment-laden runoff.

Illicit Discharges—Things to Look For

Dry weather discharge from a storm drain or in a ditch.

Eroded soil near storm drain inlets.

What to do if you suspect an Illicit Discharge

- Town bylaw provides **legal authority** to prohibit, detect, and eliminate illicit connections and discharges to the MS4

- If you see a suspected illicit discharge:
  1. If it's an immediate threat to health and safety, call 911.
  2. Otherwise, contact Justin DeMarco.
  3. Note the location, date, time, description.
  4. If possible, take a photo.

Required IDDE Activities

- Completed dry weather outfall screening Fall 2020
- Will begin wet weather screening & catchment investigations 2021

Observed during dry weather screening:

1) Flow
   - Not stormwater
   - Clean groundwater? Buried stream? Sewage?
2) Odor
3) Staining
4) Suds
5) Bacteria

Maynard Illicit Discharge Examples

OF-143 (Main St near John's Cleaners):

- orange/red flow
- very high bacteria
- VHB unable to locate upstream drainage infrastructure

OF-223 (Florida Road Bridge):

- consistent, heavy flow
- high bacteria
- sanitary sewer underdrain

Questions on Illicit Discharges?

Good Housekeeping Prevents Pollution

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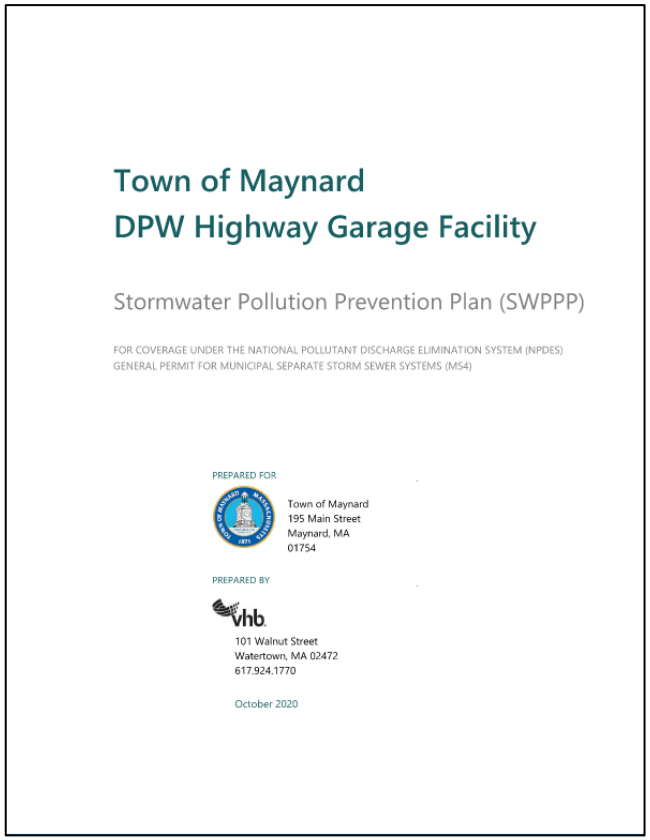
O&M Plan/ SWPPP

- Printed copies at Town Hall and Highway Garage
- Use them as references!



Town of Maynard
DPW Highway Garage Facility

Stormwater Pollution Prevention Plan (SWPPP)

FOR COVERAGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL PERMIT FOR MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)

PREPARED FOR

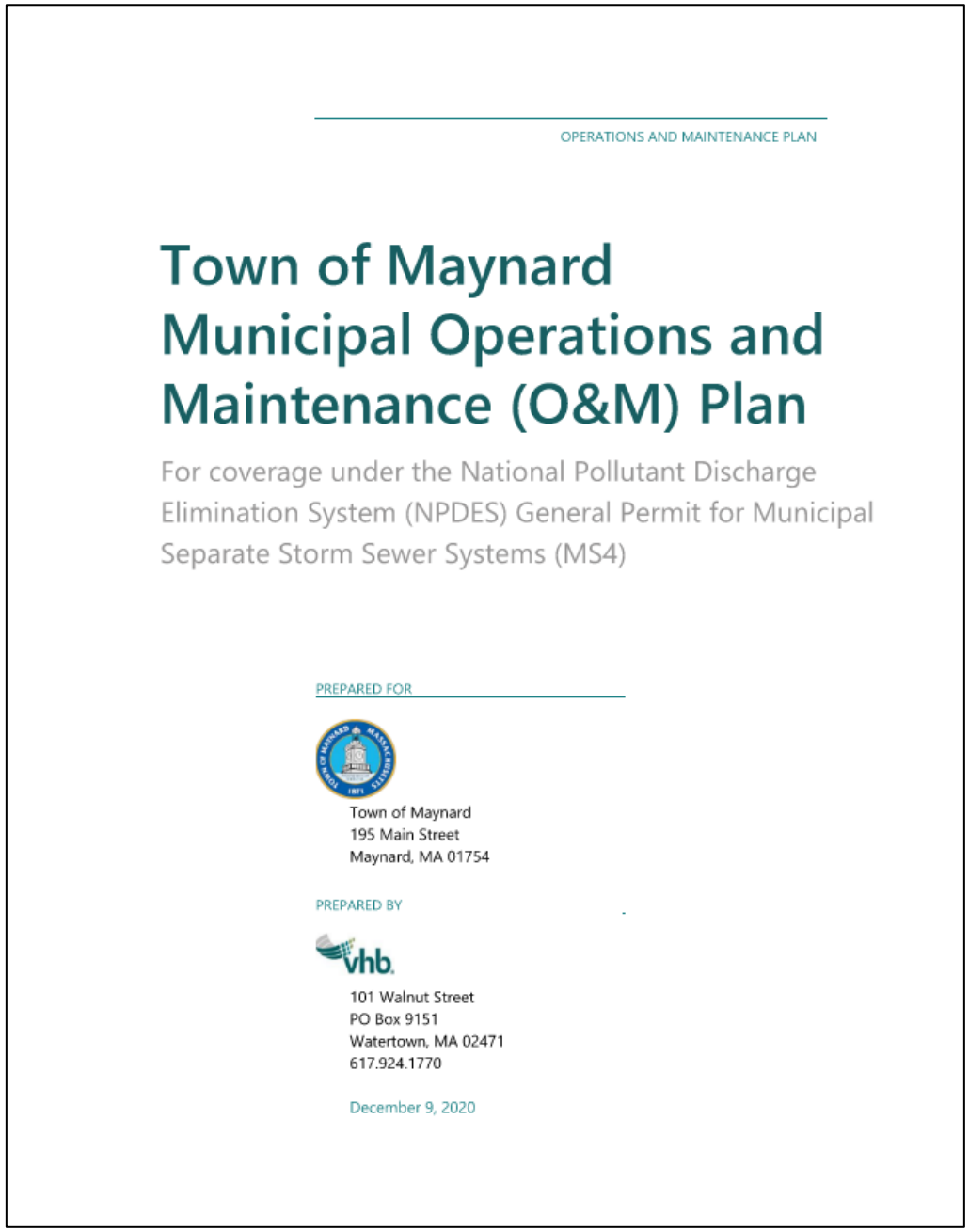
Town of Maynard
195 Main Street
Maynard, MA
01754

PREPARED BY

vhb

101 Walnut Street
Watertown, MA 02472
617.924.1770

October 2020



OPERATIONS AND MAINTENANCE PLAN

Town of Maynard
Municipal Operations and Maintenance (O&M) Plan

For coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Municipal Separate Storm Sewer Systems (MS4)

PREPARED FOR

Town of Maynard
195 Main Street
Maynard, MA 01754

PREPARED BY

vhb

101 Walnut Street
PO Box 9151
Watertown, MA 02471
617.924.1770

December 9, 2020

Municipal Activities that may Impact Water Quality

1. Parks, cemetery, and golf course maintenance
2. Facilities management
3. Vehicle/ equipment storage and maintenance
4. Street/ parking lot maintenance
5. Catch basin/ stormwater BMP maintenance
6. Winter road maintenance

Parks and Cemetery:
Parks Clean-Up & Maintenance

- Empty trash regularly
- Report/ repair erosion
- Report/ clean spills
- Never wash into storm drains
- Note waterfowl congregation and feeding areas
- Ensure proper signage

Parks and Cemetery:
Turf Maintenance

- Mow only as low as needed (2-3 inches)
- Leave grass clippings on lawn (NEVER blow into street, gutter)
- Water conservatively and efficiently
- Re-seed or mulch bare soil
- Establish low/no-mow areas in lesser-used areas
- Avoid mowing grass up to edge of water

Parks and Cemetery: Fertilizer Use

- Following state regulations on fertilizer use (330 CMR 31)
- Apply fertilizers only when necessary and at the recommended amount
- Use phosphorus only when a soil test indicates that it's needed
- Use slow-release fertilizers
- **NEVER** apply fertilizer:
  - On sidewalks or other paved surfaces
  - To saturated soils
  - Within 20 ft of stream/water body
  - Within Zone I of Maynard's water supply wells

Parks and Cemetery:
Pesticide Application

- Use licensed commercial pesticide applicator
- Keep records of when/where materials are applied
- Consider weather forecast before application

Facilities Management:
Dumpsters & Waste Handling

- Locate dumpsters on concrete or paved areas
- Do not locate dumpsters over or adjacent to catch basins
- Pick up and sweep around dumpsters regularly
- Keep lids closed and drains plugged
- Only use dumpsters for solid waste

Facilities Management:
Materials Storage

- Store chemicals indoors if possible
- Anything stored outside must be:
  - On pavement
  - Properly contained & labeled
  - Cleaned of chemical residues
- Make sure spill kits are:
  - Near all chemical storage areas
  - Fully stocked
  - Used for spills big or small

Facilities Management:
Stockpiles

Cover stockpiles to prevent contact with stormwater…

…or take steps to control runoff

Improper Stockpile management:

State Police Forensic/Tech Center Parking Lot

Vehicles & Equipment: Storage/Maintenance

- Store vehicles and equipment indoors or outdoors on pavement
- Conduct all maintenance indoors
- Inspect storage/ maintenance areas regularly

Vehicles & Equipment: Fueling

- Fuel municipal vehicles at designated fuel island or vendor
- Inspect fueling area regularly
- Immediately respond and report all spills

Vehicles & Equipment: Spill Response

- Clean all small fuel spills and leaks
- Report significant fuel spills or leaks immediately
- Frequently inspect all vehicles stored outside
  - Put absorbent material under leaking vehicles and equipment stored outside

Vehicles & Equipment:
Spill Response

Absorbent material placed on a spill…

…will end up in the storm drain if not swept up

Vehicles & Equipment: Washing

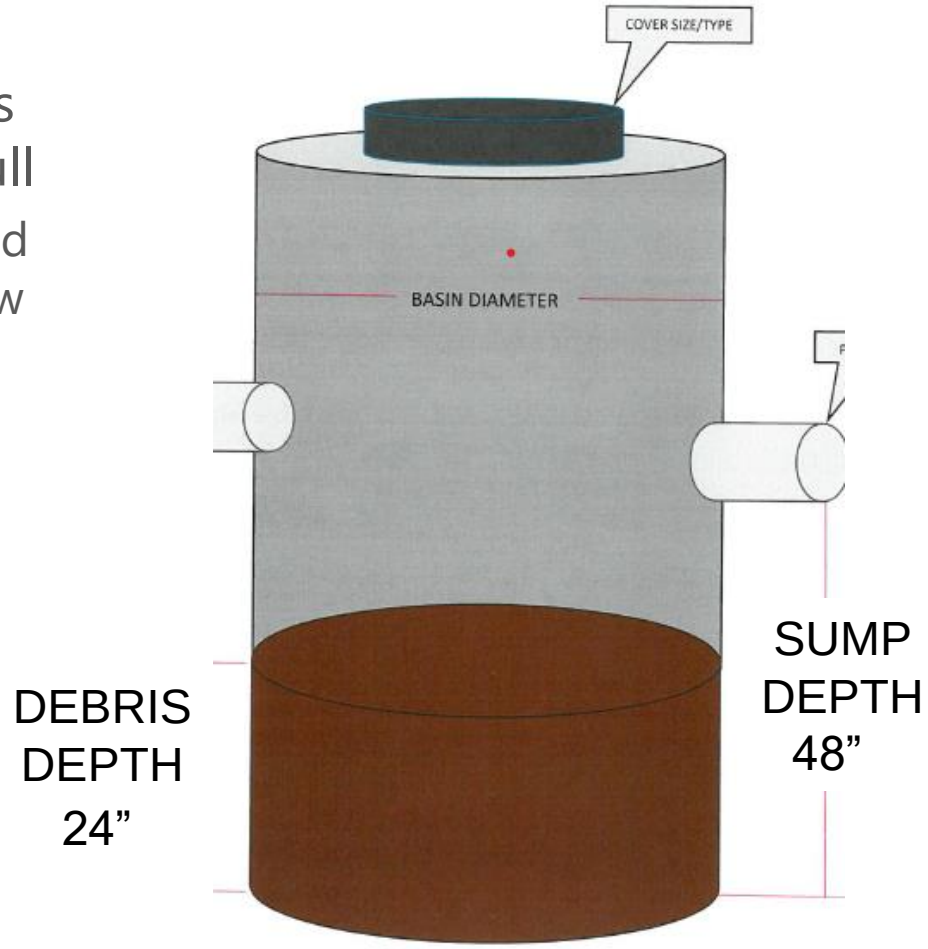
- At Highway Garage, wash vehicles and equipment in designated area
- Ensure wash water drains to vegetated area
- Use phosphate-free soap
- **NEVER** wash engine/ undercarriage outside
- **NEVER** wash near storm drains, catch basins, ditches, water bodies, or drinking water wells

Street Sweeping

- Sweep all town-owned streets and parking lots at least 2x per year
- Prioritize areas with more sediment, e.g. construction

Catch Basin Cleaning

- Inspect/clean all catch basins so that no more than 50% full
  - Clean more frequently if found more than 50% full 2x in a row
- Prioritize areas with more sediment, e.g. construction



Stormwater BMP Maintenance

- Inspect BMPs at least annually.
- Look for:
  - Blocked flow paths
  - Structural damage
  - Poor vegetative cover
  - Erosion
  - Sediment/ trash accumulation
  - Reduced infiltration/filtration
- See BMP inventory in O&M Plan and on Town's stormwater webmap
- Use inspection form provided in O&M Plan- Attachment F

Winter Road Maintenance

- Cover salt piles / Sweep spilled salt into shed
- **NEVER** dump snow into waterbodies
- Only use as much salt as necessary– salt is a pollutant


Questions or Comments?
What else can we do
to prevent pollution of
Maynard's waterbodies?

Acknowledgements:

- Cumberland County Water and Soil Conservation District
- ThinkBlue Massachusetts

Please don't forget to sign the attendance roster!

Bill Arcieri	barcieri@vhb.com	603.391.3904
Sarah Nalven	snalven@vhb.com	617.607.2646
Nate Pacheco	npacheco@vhb.com	617.607.6164

vhb®

Offices located throughout the east coast

PY3 Sign-in Sheet (3/3/2021)

Maynard Municipal Operations
Stormwater Training
March 30, 2021

Please sign in below:

Name	Signature	Date
Katie Young		3/30/21
WAYNE AMICO		3/30/21
Matti Tuomi		3/30/21
Matt McDonald		3/30/21
Jake Dougherty		3/30/21
Joe Worthington		3-30-21
Mike Cassidy		3/30/21
Tim Mullaney	TIM MULLANEY	3/30/21
		3/30/21
FOSTER	JOE FOSTER	3/30/21
Nate Dee		3/30/21
Craig Gonsalves Jr.		3-30-21
Shawn Dickerson		3-30-21
Kyle Brainard		3/30/21
Trustee Owen		3/30/21
Marc Currier		3/30/21

Appendix E

Source Isolation and Confirmation Methods: Instructions, Manuals, and SOPs

Dry Weather Outfall Inspection SOP

SOP 1: DRY WEATHER OUTFALL INSPECTION

Introduction

Outfalls from an engineered storm drain system can be in the form of pipes or ditches. Under current and pending regulations, it is important to inspect and document water quality from these outfalls under both dry weather and wet weather conditions. SOP 2, "Wet Weather Outfall Inspection", covers the objectives of that type of inspection. This SOP discusses the dry weather inspection objectives, and how they differ from wet weather inspection objectives.

During a dry weather period, it is anticipated that minimal flow from stormwater outfalls will be observed. Therefore, dry weather inspections aim to characterize any/all flow observed during a dry weather period and identify potential source(s) of an illicit discharge through qualitative testing; further described in SOP 13, "Water Quality Screening in the Field".

Objectives of Dry Weather Inspections

A dry weather period is a time interval during which less than 0.1 inch of rain is observed across a minimum of 72 hours. Unlike wet weather sampling, dry weather inspections are not intended to capture a "first flush" of stormwater discharge, rather they are intended to identify any/all discharges from a stormwater outfall during a period without recorded rainfall. The objective of inspections during a dry weather period is to characterize observed discharges and facilitate detection of illicit discharges.

Visual Condition Assessment

The attached Dry Weather Outfall Inspection Survey is a tool to assist in documenting observations related to the both quantitative and qualitative characteristics of any/all flows conveyed by the structure during a dry period.

For any visual observation of pollution in a stormwater outfall discharge, an investigation into the pollution source should occur, but the following are often true:

1. Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
2. Oil sheen: result of a leak or spill.
3. Cloudiness: indicator of suspended solids such as dust, ash, powdered chemicals and ground up materials.
4. Color or odor: Indicator of raw materials, chemicals, or sewage.
5. Excessive sediment: indicator or disturbed earth of other unpaved areas lacking adequate erosion control measures.
6. Sanitary waste and optical enhancers (fluorescent dyes added to laundry detergent and some toilet paper): indicators of illicit discharge.
7. Orange staining: indicator of high mineral concentrations.

Many of these observations are indicators of an illicit discharge. Examples of illicit discharges include: cross-connections of sewer services to engineered storm drain systems; leaking septic systems; intentional discharge of pollutants to catch basins; combined sewer overflows; connected floor drains; and sump pumps connected to the system (under some circumstances). Additional guidelines for illicit discharge investigations are included in SOP 10, "Locating Illicit Discharges".

The Wet Weather Outfall Inspection Survey includes fields where these and other specific observations can be noted. The inspector shall indicate the presence of a specific water quality indicator or parameter by marking "Yes". If "Yes" is marked, provide additional details in the comments section. If the indictor in question is not present mark "No".

Within the comments section, provide additional information with regard to recorded precipitation totals, or more detailed descriptions of observations made during the inspection and corrective actions taken.

Conditional and Qualitative Considerations

Although many of the parameters listed above are considered to be indicators of illicit discharge, the presence of a parameter is not absolute evidence of an illicit discharge.

Some of these indicators may occur naturally. Orange staining may be the result of naturally occurring iron, and therefore unrelated to pollution. Foam can be formed when the physical characteristics of water are altered by the presence of organic materials. Foam is typically found in waters with high organic content such as bog lakes, streams that originate from bog lakes, productive lakes, wetlands, or woody areas. To determine the difference between natural foam and foam cause by pollution, consider the following:

1. Wind direction or turbulence: natural foam occurrences on the beach coincide with onshore winds. Often, foam can be found along a shoreline and/or on open waters during windy days. Natural occurrences in rivers can be found downstream of a turbulent site.
2. Proximity to a potential pollution source: some entities including the textile industry, paper production facilities, oil industries, and fire fighting activities work with materials that cause foaming in water. If these materials are released to a water body in large quantities, they can cause foaming. Also, the presence of silt in water, such as from a construction site can cause foam.
3. Feeling: natural foam is typically persistent, light, not slimy to the touch.
4. Presence of decomposing plants or organic material in the water.

Some of the indicators can have multiple causes or sources. For example, both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear "blocky". Bacterial or naturally occurring sheens are usually silver or relatively dull in color and will break up into a number of small patches of sheen. The cause may be

presence of iron, decomposition of organic material or presence of certain bacteria. Bacterial sheen is not a pollutant but should be noted.

Optical enhancers at high concentrations are sometimes visible to the naked eye as a bluish-purple haze in the water. However, due to physiological variation of the human eye, not all inspectors may be able to identify the presence of these materials, and quantitative testing is the preferred method to confirm the presence of these compounds. Optical enhancers are typically detected through the use of clean, white cotton pads placed within the discharge for several days, dried, and viewed under a fluorometer. If the cotton pad fluoresces, optical enhancers are assumed to be present. The magnitude of the fluorescence, as measured in fluorescent units, can be used to correlate the concentration of optical enhancers in water to other samples collected locally.

Measuring Water Quality

Based on the results of the Visual Condition Assessment, it may be necessary to collect additional data about water quality. Water quality samples can be in the form of screening using field test kits and instrumentation, or by discrete analytical samples processed by a laboratory.

Information on selecting and using field test kits and instrumentation is included in SOP 13, "Water Quality Screening in the Field." The Inspection Survey also provides values for what can be considered an appropriate benchmark for a variety of parameters that can be evaluated in the field.

If the results of screening using field test kits indicate that the outfall's water quality exceeds the benchmarks provided, collection of discrete analytical samples should be considered.

Analytical Sample Collection

Sample collection methods may vary based on specific outfall limitations, but shall follow test procedures outlined in 40 CFR 136. A discrete manual or grab sample can classify water at a distinct point in time. These samples are easily collected and used primarily when the water quality of the discharge is expected to be homogeneous, or unchanging, in nature. A flow-weighted composite sample will classify water quality over a measured period of time. These samples are used when the water quality of the discharge is expected to be heterogeneous, or fluctuating, in nature. Grab samples are more common for dry weather outfall inspections due to the time-sensitive nature of the process.

Protocols for collecting a grab sample shall include the following:

1. Do not eat, drink or smoke during sample collection and processing.
2. Do not collect or process samples near a running vehicle.
3. Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.
4. Always wear clean, powder-free nitrile gloves when handling sample containers and lids.
5. Never touch the inside surface of a sample container or lid, even with gloved hands.

6. Never allow the inner surface of a sample container or lid to be contacted by any material other than the sample water.
7. Collect samples while facing upstream and so as not to disturb water or sediments in the outfall pipe or ditch.
8. Do not overfill sample containers, and do not dump out any liquid in them. Liquids are often added to sample containers intentionally by the analytical laboratory as a preservative or for pH adjustment.
9. Slowly lower the bottle into the water to avoid bottom disturbance and stirring up sediment.
10. Do not allow any object or material to fall into or contact the collected water sample.
11. Do not allow rainwater to drip from rain gear or other surfaces into sample containers.
12. Replace and tighten sample container lids immediately after sample collection.
13. Accurately label the sample with the time and location.
14. Document on the Wet Weather Outfall Inspection Survey that analytical samples were collected, specify parameters, and note the sample time on the Inspection Survey. This creates a reference point for samples.

Analytical Sample Quality Control and Assurance

Upon completion of successful sample collection, the samples must be sent or delivered to a MassDEP-approved laboratory for analytical testing. Quality control and assurance are important to ensuring accurate analytical test results.

Sample preservation is required to prevent contaminate degradation between sampling and analysis, and should be completed in accordance with 40 CFR 136.3.

Maximum acceptable holding times are also specified for each analytical method in 40 CFR 136.3. Holding time is defined as the period of time between sample collection and extraction for analysis of the sample at the laboratory. Holding time is important because prompt laboratory analysis allows the laboratory to review the data and if analytical problems are found, re-analyze the affected samples within the holding times.

Chain of custody forms are designed to provide sample submittal information and document transfers of sample custody. The forms are typically provided by the laboratory and must be completed by the field sampling personnel for each sample submitted to the lab for analysis. The document must be signed by both the person releasing the sample and the person receiving the sample every time the sample changes hands. The sampling personnel shall keep one copy of the form and send the remaining copies to the laboratory with the samples. Custody seals, which are dated, signed and affixed to the sample container, may be used if the samples are shipped in a cooler via courier or commercial overnight shipping.

Attachments

1. Dry Weather Outfall Inspection Survey

Related Standard Operating Procedures

1. SOP 2, Wet Weather Outfall Inspection
2. SOP 10, Locating Illicit Discharges
3. SOP 13, Water Quality Screening in the Field

Wet Weather Outfall Inspection SOP

SOP 2: WET WEATHER OUTFALL INSPECTION

Introduction

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Definition of Wet Weather

A storm is considered a representative wet weather event if greater than 0.1 inch of rain falls and occurs at least 72 hours after the previously measurable (greater than 0.1 inch of rainfall) storm event. In some watersheds, based on the amount of impervious surface present, increased discharge from an outfall may not result from 0.1 inch of rain. An understanding of how outfalls respond to different events will develop as the inspection process proceeds over several months, allowing the inspectors to refine an approach for inspections.

Ideally, the evaluation and any samples collected should occur within the first 30 minutes of discharge to reflect the first flush or maximum pollutant load.

Typical practice is to prepare for a wet weather inspection event when weather forecasts show a 40% chance of rain or greater. If the inspector intends to collect analytical samples, coordination with the laboratory for bottleware and for sample drop-off needs to occur in advance.

Visual Condition Assessment

The attached Wet Weather Outfall Inspection Survey should be used to document observations related to the quality of stormwater conveyed by the structure. Observations such as the following can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash and debris

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1. Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
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Measuring Water Quality

Based on the results of the Visual Condition Assessment, it may be necessary to collect additional data about water quality. Water quality samples can be in the form of screening using field test kits or by discrete analytical samples processed by a laboratory.

Information on how to use field test kits is included in SOP 13, "Water Quality Screening with Field Test Kits", and the Wet Weather Outfall Inspection Survey includes fields to document the results of such screening. The Inspection Survey also provides values for what can be considered an appropriate benchmark for a variety of parameters that can be evaluated with field test kits.

If the results of screening using field test kits indicate that the outfall's water quality exceeds the benchmarks provided, collection of discrete analytical samples should be considered.

Analytical Sample Collection

Sample collection methods may vary based on specific outfall limitations but shall follow test procedures outlined in 40 CFR 136. A discrete manual or grab sample can classify water at a distinct point in time. These samples are easily collected and used primarily when the water quality of the discharge is expected to be homogeneous, or unchanging, in nature. A flow-weighted composite sample will classify water quality over a measured period of time. These samples are used when the water quality of the discharge is expected to be heterogeneous, or fluctuating, in nature. Grab samples are more common for wet weather outfall inspections due to the time-sensitive nature of the process.

Protocols for collecting a grab sample shall include the following:

1. Do not eat, drink or smoke during sample collection and processing.
2. Do not collect or process samples near a running vehicle.
3. Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.
4. Always wear clean, powder-free nitrile gloves when handling sample containers and lids.
5. Never touch the inside surface of a sample container or lid, even with gloved hands.
6. Never allow the inner surface of a sample container or lid to be contacted by any material other than the sample water.
7. Collect samples while facing upstream and so as not to disturb water or sediments in the outfall pipe or ditch.
8. Do not overfill sample containers, and do not dump out any liquid in them. Liquids are often added to sample containers intentionally by the analytical laboratory as a preservative or for pH adjustment.
9. Slowly lower the bottle into the water to avoid bottom disturbance and stirring up sediment.
10. Do not allow any object or material to fall into or contact the collected water sample.
11. Do not allow rainwater to drip from rain gear or other surfaces into sample containers.
12. Replace and tighten sample container lids immediately after sample collection.
13. Accurately label the sample with the time and location.
14. Document on the Wet Weather Outfall Inspection Survey that analytical samples were collected, specify parameters, and note the sample time on the Inspection Survey. This creates a reference point for samples.

Analytical Sample Quality Control and Assurance

Upon completion of successful sample collection, the samples must be sent or delivered to a MassDEP-approved laboratory for analytical testing. Quality control and assurance are important to ensuring accurate analytical test results.

Sample preservation is required to prevent contaminant degradation between sampling and analysis and should be completed in accordance with 40 CFR 136.3.

Maximum acceptable holding times are also specified for each analytical method in 40 CFR 136.3. Holding time is defined as the period of time between sample collection and extraction for analysis of the sample at the laboratory. Holding time is important because prompt laboratory analysis allows the laboratory to review the data and if analytical problems are found, re-analyze the affected samples within the holding times.

Chain of custody forms are designed to provide sample submittal information and document transfers of sample custody. The forms are typically provided by the laboratory and must be completed by the field sampling personnel for each sample submitted to the lab for analysis. The document must be signed by both the person releasing the sample and the person receiving the sample every time the sample changes hands. The sampling personnel shall keep one copy of the form and send the remaining copies to the

laboratory with the samples. Custody seals, which are dated, signed and affixed to the sample container, may be used if the samples are shipped in a cooler via courier or commercial overnight shipping.

Attachments

1. Wet Weather Outfall Inspection Survey

Related Standard Operating Procedures

1. SOP 1, Dry Weather Outfall Inspection
2. SOP 10, Locating Illicit Discharges
3. SOP 13, Water Quality Screening in the Field

Water Quality Screening in the Field SOP

SOP 13: WATER QUALITY SCREENING IN THE FIELD

Introduction

Outfalls from an engineered storm drain system can be in the form of pipes or ditches. Under current and pending regulations, it is important to inspect and document water quality within the MS4 system under both dry weather and wet weather conditions. SOP 1, "Dry Weather Outfall Inspection" and SOP 2, "Wet Weather Outfall Inspection", cover the objectives of these activities and how water quality parameters can be collected during both types of inspections. SOP 3, "Catch Basin Inspection and Cleaning", describes how this operations and maintenance activity can serve as an additional opportunity to collect water quality data.

SOP 2 included detailed information on how to collect discrete analytical samples to be processed by a laboratory. In contrast, this SOP addresses screening-level measurements than can be collected at outfalls, catch basins, receiving waters, or other water bodies. The measurements can be collected with field test kits or with portable meters.

Water quality screening data collected in this manner can feed into an illicit discharge detection and elimination investigation, like the process described in SOP 10, "Locating Illicit Discharges".

Visual Condition Assessment

SOP 1, SOP 2, and SOP 3 describe a Visual Condition Assessment to collect observations related to the quality of stormwater conveyed by an engineered storm drain system. These observations may include such visual evidence and/or potential pollutants as:

- Foaming (detergents)
- Discoloration
- Evidence of sanitary waste
- Optical enhancers (fluorescent dyes added to laundry detergent); and
- Turbidity

If a Visual Condition Assessment indicates the presence of these pollutants, it may be necessary to quantify the extent of each, and gather data on other parameters that cannot be visually observed but can be measured using field kits or meters. These parameters include:

- Ammonia
- Chloride (present in treated drinking water but not groundwater)
- Conductivity
- Fluoride
- Hardness
- pH
- Potassium

Field Kits and Sampling Methods Available

In recent drafts of new MS4 Permits, U.S. EPA Region 1 has identified several test kits that are acceptable for use in the field, and other regulatory agencies have also completed similar reviews. The following table shows field test kits and portable meters that can be used for screening parameters.

Table SOP 13-1
Field Measurements, Test Kits, and Instrumentation

Analyte or Parameter	Instrumentation (Portable meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) Hach™ NI-SA Hach™ Ammonia Test Strips
Bacteria	Bacteria field test kits require 24-hour window	
Boron	N/A	Hanna™ HI 38074 Taylor™ K-1541
Chloride	CHEMetrics™ V-2000 Colorimeter Hach™ Pocket Colorimeter™ II LaMotte™ DC1200 Colorimeter	CHEMetrics™ K-2002 through K-2070 Hach™ CDS-DT Hach™ Chloride QuanTab® Test Strips
Color		Hach™ ColorDisc
Conductivity	CHEMetrics™ I-1200	N/A
Detergents (Surfactants)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Fluoride	CHEMetrics™ V-2000 Colorimeter Hach™ Pocket Colorimeter™ II	N/A
Hardness	N/A	CHEMetrics™ K-1705 and K-1710 CHEMetrics™ K-4502 through K-4530 Hach™ HA-DT Hach™ Hardness Test Strips
Optical enhancers	Field tests still under development	
pH	CHEMetrics™ I-1000	Hach™ 17J through 17N Hach™ pH Test Strips
Potassium	Horiba™ Cardy C-131	LaMotte™ 3138 KIW
Turbidity	CHEMetrics™ I-1300	N/A

Each field test kit will include instructions specific to that test kit, and most kits are available in configurations that detect different ranges of the parameter. For example, the CHEMetrics™ detergents kit K-9400 shown above detects concentrations of 0 to 3 milligrams per liter (mg/L) while the K-9404 kit detects concentrations of 0 to 1,400 mg/L.

The table below shows values identified by the U.S. EPA and the Center for Watershed Protection as typical screening values for select parameters. These represent the typical concentration (or value) of each parameter expected to be found in stormwater. Screening values that exceed these benchmarks may be indicative of pollution and/or illicit discharges.

Table SOP 13-2
Benchmark Field Measurements for Select Parameters

Analyte or Parameter	Benchmark
Ammonia	>0.5 mg/L
Conductivity	>2,000
Detergents (Surfactants)	> 0.25 mg/L
Fluoride	>0.25 mg/L
pH	<5
Potassium	>20 mg/L

If and when water quality screening samples, whether using field test kits or portable meters, exceed these benchmark concentrations, the inspector should consider collecting analytical samples for laboratory analysis.

Advantages and Disadvantages of Field Testing

Field test kits can be convenient for use as a screening tool, initial purchase costs are low (typically $0.50 to $5.00 for the kits included in Table SOP 13-1), and the costs are far less than full analyses at a laboratory. However, some disadvantages of this screening method include:

- Limited shelf life
- Labor cost associated with inspector's time
- Generation of wastes, including glass vials and used reagent
- Steps and processes for each kit can vary widely, resulting in errors
- Trained staff are required in order to effectively utilize kits
- Not all kits are accepted by all regulatory agencies
- Limited useful detection range

Portable instrumentation such as the colorimeters shown in Table SOP 13-1 have the benefit of providing accurate readings, measure to low detection limits, and can be purchased pre-programmed to measure concentrations of most parameters required. Disadvantages of portable instrumentation include:

- High initial purchase cost
- Requirement for ongoing calibration and maintenance
- Individual probes require periodic replacement
- Specific storage requirements to maintain calibration
- Trained staff are required in order to effectively utilize meters

Related Standard Operating Procedures

1. SOP 1, Dry Weather Outfall Inspection
2. SOP 2, Wet Weather Outfall Inspection
3. SOP 3, Catch Basin Cleaning and Inspection
4. SOP 10, Locating Illicit Discharges

WATER QUALITY SCREENING FORM

Outfall I.D.			
Outfall Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Most Recent Storm Event			

FIELD WATER QUALITY SCREENING RESULTS

Sample Parameter	Field Test Kit or Portable Instrument Meter	Benchmark	Field Screening Result	Full Analytical Required?
Ammonia[1]		> 0.5 mg/L		☐ Yes ☐ No
Boron[1]		> 0.35 mg/L		☐ Yes ☐ No
Chloride[2]		230 mg/L		☐ Yes ☐ No
Color[1]		> 500 units		☐ Yes ☐ No
Specific Conductance[1]		> 2,000 µS/cm		☐ Yes ☐ No
Detergents & Surfactants[3]		> 0.25 mg/L		☐ Yes ☐ No
Fluoride[3]		> 0.25 mg/L		☐ Yes ☐ No
Hardness[1]		< 10 mg/L or > 2,000 mg/L		☐ Yes ☐ No
pH[1]		< 5		☐ Yes ☐ No
Potassium[1]		> 20 mg/L		☐ Yes ☐ No
Turbidity[1]		> 1,000 NTU		☐ Yes ☐ No

[1] – *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection and Robert Pitt of University of Alabama, 2004, p. 134, Table 45.

[2] –*Env-Ws 1703.21 Water Quality Criteria for Toxic Substances*, State of New Hampshire Department Surface Water Quality Regulations.

[3] – *Appendix I – Field Measurements, Benchmarks and Instrumentation*, Draft Massachusetts North Coastal Small MS4 General Permit, 2009.

FULL ANALYTICAL TESTING WATER QUALITY RESULTS

Sample Parameter	Analytical Test Method	Sample Collection (Time/Date)	Testing Lab	Analytical Testing Result
Ammonia	EPA 350.2/SM4500-NH3C			
Bacteria	E coli: 1103.1; 1603 Enterococcus: 1106.1; 1600			
Boron	EPA 212.3			
Chloride	EPA 9251			
Color	EPA 110.2			
Specific Conductance	SM 2510B			
Detergents & Surfactants	EPA 425.1/SM5540C			
Fluoride	EPA 300.0			
Hardness	EPA 130.1/SM 2340B			
Optical Enhancers	N/A*			
pH	EPA 150.1/SM 4500H			
Potassium	EPA 200.7			
Turbidity	SM 2130B			

*- There is presently no USEPA Standard Method for analysis of optical enhancers. Typically, sample pads are described as with "Present" or "Not Present" for fluorescing dye when exposed to UV light or a fluorometer.

Locating Illicit Discharges SOP

SOP 10: LOCATING ILLICIT DISCHARGES

Introduction

An "illicit discharge" is any discharge to an engineered storm drain system that is not composed entirely of stormwater unless the discharge is defined as an allowable non-stormwater discharge under the 2003 Massachusetts MS4 Permit. Illicit discharges may enter the engineered storm drain system through direct or indirect connections, such as: cross-connections of sewer services to engineered storm drain systems; leaking septic systems; intentional discharge of pollutants to catch basins; combined sewer overflows; connected floor drains; and sump pumps connected to the system (under some circumstances). Illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to receiving streams.

Illicit discharges can be located by several methods, including routine dry weather outfall inspections and catch basin inspections, which are described in detail in SOP 1, "Dry Weather Outfall Inspection" and SOP 3, "Catch Basin Inspection and Cleaning", respectively, as well as from citizen reports.

This SOP assumes that the municipality has legal authority (i.e., a bylaw or ordinance) in place, per the requirements of the 2003 Massachusetts MS4 Permit, to prohibit the connection of non-stormwater discharges into the storm drain system. The authority or department for addressing illicit discharge reports would be clearly identified in the municipality's legal authority. In Massachusetts, this is typically a combination of the Board of Health, the Department of Public Works (or Highway Department), and the local sanitary sewer department or commission. In some communities, the Conservation Commission may also play a role. This SOP refers to "appropriate authority" generically to reflect differences in how municipalities have identified these roles.

Identifying Illicit Discharges

The following are often indicators of an illicit discharge from stormwater outfall:

1. Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
2. Oil sheen: result of a leak or spill.
3. Cloudiness: indicator of suspended solids such as dust, ash, powdered chemicals and ground up materials.
4. Color or odor: Indicator of raw materials, chemicals, or sewage.
5. Excessive sediment: indicator of disturbed earth of other unpaved areas lacking adequate erosion control measures.
6. Sanitary waste and optical enhancers (fluorescent dyes added to laundry detergent): indicator of the cross-connection of a sewer service.
7. Orange staining: indicator of high mineral concentrations.

Both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by oil will remain intact and move in

a swirl pattern; a sheen caused by bacteria will separate and appear "blocky". Bacterial sheen is not a pollutant but should be noted.

Citizen Call in Reports

Reports by residents and other users of a water body can be effective tools in identifying the presence of illicit discharges. Many communities have set up phone hotlines for this purpose, or have provided guidance to local police departments and dispatch centers to manage data reported in this manner. Municipal employees and the general public should receive education to help identify the signs of illicit discharges and should be informed how to report such incidents.

When a call is received about a suspected illicit discharge, the attached IDDE Incident Tracking Sheet shall be used to document appropriate information. Subsequent steps for taking action to trace, document, and eliminate the illicit discharge are described in the following sections.

Potential illicit discharges reported by citizens should be reviewed on an annual basis to locate patterns of illicit discharges, identify high-priority catchments, and evaluate the call-in inspection program.

Tracing Illicit Discharges

Whenever an illicit discharge is suspected, regardless of how it was identified, the attached IDDE Incident Tracking Sheet should be utilized. The Incident Tracking Sheet shall be provided to the appropriate authority (i.e., Board of Health, Department of Public Works, etc.), which shall promptly investigate the reported incident.

If the presence of an illicit discharge is confirmed by the authority, but its source is unidentified, additional procedures to determine the source of the illicit discharge should be completed.

1. Review and consider information collected when illicit discharge was initially identified, for example, the time of day and the weather conditions for the previous 72 hours. Also consider and review past reports or investigations of similar illicit discharges in the area.
2. Obtain storm drain mapping for the area of the reported illicit discharge. If possible, use a tracking system that can be linked to your system map, such as GIS.
3. Document current conditions at the location of the observed illicit discharge point, including odors, water appearance, estimated flow, presence of floatables, and other pertinent information. Photograph relevant evidence.
4. If there continues to be evidence of the illicit discharge, collect water quality data using the methods described in SOP 13, "Water Quality Screening in the Field". This may include using field test kits or instrumentation, or collecting analytical samples for full laboratory analysis.
5. Move upstream from the point of observation to identify the source of the discharge, using the system mapping to determine infrastructure, tributary pipes, and drainage areas that contribute. At each point, survey the general area and surrounding properties to identify potential sources of the illicit discharge. Document observations at each point on the IDDE Incident Tracking Sheet as well as with photographs.
6. Continue this process until the illicit discharge is no longer observed, which will define the boundaries of the likely source. For example if the illicit discharge is present in catch basin 137

but not the next upstream catch basin, 138, the source of the illicit discharge is between these two structures.

If the source of the illicit discharge could not be determined by this survey, consider using dye testing, smoke testing, or closed-circuit television inspection (CCTV) to locate the illicit discharge.

Dye Testing

Dye testing is used to confirm a suspected illicit connection to a storm drain system. Prior to testing, permission to access the site should be obtained. Dye is discharged into the suspected fixture, and nearby storm drain structures and sanitary sewer manholes observed for presence of the dye. Each fixture, such as sinks, toilets, and sump pumps, should be tested separately. A third-party contractor may be required to perform this testing activity.

Smoke Testing

Smoke testing is a useful method of locating the source of illicit discharges when there is no obvious potential source. Smoke testing is an appropriate tracing technique for short sections of pipe and for pipes with small diameters. Smoke added to the storm drain system will emerge in connected locations. A third-party contractor may be required to perform this testing activity.

Closed Circuit Television Inspection (CCTV)

Televised video inspection can be used to locate illicit connections and infiltration from sanitary sewers. In CCTV, cameras are used to record the interior of the storm drain pipes. They can be manually pushed with a stiff cable or guided remotely on treads or wheels. A third-party contractor may be required to perform this testing activity.

If the source is located, follow steps for removing the illicit discharge. Document repairs, new sanitary sewer connections, and other corrective actions required to accomplish this objective. If the source still cannot be located, add the pipe segment to a future inspection program.

This process is demonstrated visually on the last page of this SOP.

Removing Illicit Discharges

Proper removal of an illicit discharge will ensure it does not recur. Refer to Table SOP 10-1, attached for, for examples of the notification process.

In any scenario, conduct a follow up inspection to confirm that the illicit discharge has been removed. Suspend access to the storm drain system if an "imminent and substantial danger" exists or if there is a threat of serious physical harm to humans or the environment.

Attachments

1. Illicit Discharge Incident Tracking Sheet

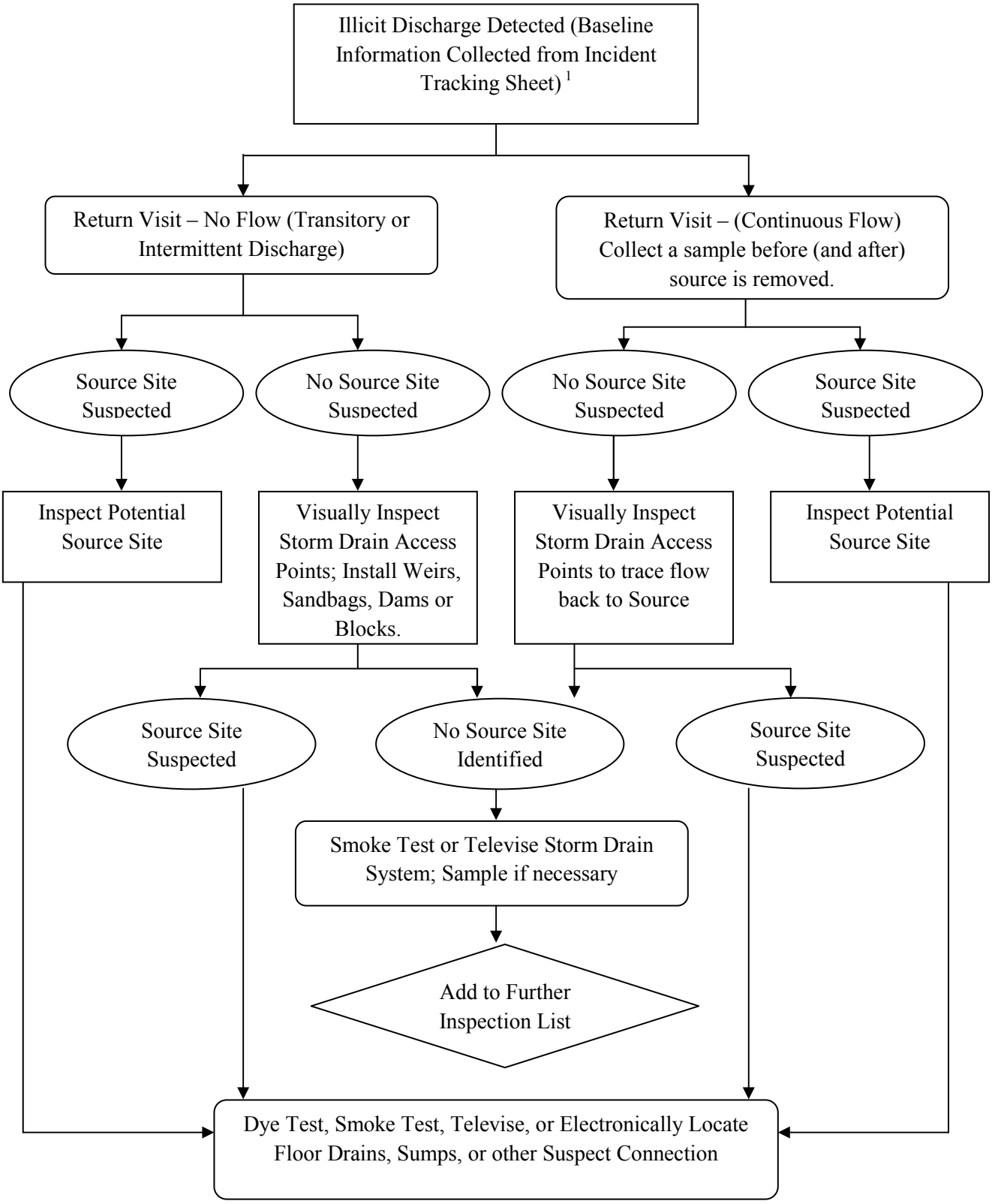
Related Standard Operating Procedures

1. SOP 1: Dry Weather Outfall Inspection
2. SOP 2: Wet Weather Outfall Inspection
3. SOP 3: Catch Basin Inspection
4. SOP 13: Using Field Test Kits For Outfall Screening
5. SOP 15: Private Drainage Connections

Table SOP 10-1

Notification and Removal Procedures for Illicit Discharges into the Municipal Separate Storm Sewer System

Financially Responsible	Source Identified	Enforcement Authority	Procedure to Follow
Private Property Owner	One-time illicit discharge (e.g. spill, dumping, etc.)	Ordinance enforcement authority (e.g. Code Enforcement Officer)	• Contact Owner • Issue Notice of Violation • Issue fine
Private Property Owner	Intermittent or continuous illicit discharge from legal connection	Ordinance enforcement authority (e.g. Code Enforcement Officer)	• Contact Owner • Issue Notice of Violation • Determine schedule for removal • Confirm removal
Private Property Owner	Intermittent or continuous illicit discharge from illegal connection or indirect (e.g. infiltration or failed septic)	Plumbing Inspector or ordinance enforcement authority	• Notify Plumbing Inspector or ordinance enforcement authority
Municipal	Intermittent or continuous illicit discharge from illegal connection or indirect (e.g. failed sewer line)	Ordinance enforcement authority (e.g. Code Enforcement Officer)	• Issue work order • Schedule removal • Remove connection • Confirm removal
Exempt 3rd Party	Any	USEPA	• Notify exempt third party and USEPA of illicit discharge


Illicit Discharge Detected (Baseline Information Collected from Incident Tracking Sheet) [1]
Return Visit – No Flow (Transitory or Intermittent Discharge)
Return Visit – (Continuous Flow) Collect a sample before (and after) source is removed.
Source Site Suspected
No Source Site Suspected
No Source Site Suspected
Source Site Suspected
Inspect Potential Source Site
Visually Inspect Storm Drain Access Points; Install Weirs, Sandbags, Dams or Blocks.
Visually Inspect Storm Drain Access Points to trace flow back to Source
Inspect Potential Source Site
Source Site Suspected
No Source Site Identified
Source Site Suspected
Smoke Test or Televise Storm Drain System; Sample if necessary
Add to Further Inspection List
Dye Test, Smoke Test, Televise, or Electronically Locate Floor Drains, Sumps, or other Suspect Connection

[1] – *Guidelines and Standard Operating Procedures: Illicit Discharge Detection and Elimination and Pollution Prevention/Good Housekeeping for Stormwater Phase II Communities in New Hampshire,* New Hampshire Estuary Project, 2006, p. 25, Figure 2-1.

Illicit Discharge Incident Tracking Sheet

Incident ID:				
Responder Information (for Citizen-Reported issues)				
Call Taken By:		Call Date:		
Call Time:		Precipitation (inches) in past 24-48 hours:		
Observer Information				
Date and Time of Observation:		Observed During Regular Maintenance or Inspections? ☐ Yes ☐ No		
Caller Contact Information (optional) or Municipal Employee Information:				
Observation Location: (complete one or more below)				
Latitude and Longitude:				
Stream Address or Outfall #:				
Closest Street Address:				
Nearby Landmark:				
Primary Location Description		**Secondary Location Description:**		
☐Stream Corridor (In or adjacent to stream)		☐Outfall	☐In-stream Flow	☐Along Banks
☐Upland Area (Land not adjacent to stream)		☐Near Storm Drain	☐Near other water source (stormwater pond, wetland, ect.):	
Narrative description of location:				
Upland Problem Indicator Description				
☐Dumping	☐Oil/Solvents/Chemicals		☐Sewage	
☐Detergent, suds, etc.	☐Other:_____			
Stream Corridor Problem Indicator Description				
Odor	☐None	☐Sewage	☐Rancid/Sour	☐Petroleum (gas)
	☐Sulfide (rotten eggs); natural gas	☐Other: Describe in "Narrative" section		
Appearance	☐"Normal"	☐Oil Sheen	☐Cloudy	☐Foam
	☐Optical enhancers	☐ Discolored		
	☐Other: Describe in "Narrative" section			
Floatables	☐None	☐Sewage (toilet paper, etc)	☐Algae	☐Trash or debris
	☐Other: Describe in "Narrative" section			
Narrative description of problem indicators:				
Suspected Source (name, personal or vehicle description, license plate #, address, etc.):				

CMRSWC

Dye Testing SOP

ENVIRONMENT, HEALTH & SAFETY
UNIVERSITY OF MICHIGAN

Dye Testing for Storm Water and Sanitary Systems

Guideline

Issue Date: 05/05/2000
Revision Date: 11/01/2017

Applies To: University of Michigan employees and contractors performing dye testing.

This guideline is for dye testing of the storm water and sanitary sewer systems on the University of Michigan (U-M) Ann Arbor Campus. Dye testing is conducted as part of the U-M National Pollutant Discharge Elimination System (NPDES) storm water discharge permit in order to check for illicit connections. Dye testing is regulated under Rule 97 of Michigan Water Quality Standards. This regulation requires that the Michigan Department of Environmental Quality (MDEQ) approve all dye testing.

Prior to dye testing approvals, the contractor or person(s) performing the dye test must fully read and understand these guidelines and must submit all information requested to Environment, Health & Safety (EHS). Additionally, **this form must be signed and submitted to EHS, Environmental Protection and Permitting Program (EP3)**, signifying acceptance to the terms and conditions herein.

1. Call EHS, EP3 at 734-936-1920, **a minimum of seventy-two (72) hours** prior to any dye testing to accommodate the required MDEQ advance notice.

2. Provide the location of the proposed dye test. Be specific, so that the potential receiving water can be determined by EHS, EP3 through a review of the campus storm water system maps.

3. EHS, EP3 will forward dye testing requests to the MDEQ Jackson District Office. EHS, EP3 will also notify other units on campus that should be aware of the activities, such as the Plumbing Shop, the Department of Public Safety and the EHS on-call emergency responder. EHS, EP3 will also contact the City of Ann Arbor Waste Water Treatment Plant, the Washtenaw County Water Resources Commissioner, and Washtenaw County Department of Environmental Health.

4. After the dye testing notification has been made, dye can be obtained from EHS, EP3 (734-936-1920). Before obtaining the dye, all requested information requested herein, including a signed copy of this form must be submitted to EHS, EP3. Follow the manufacturer's recommendation on the amount of dye used. Norlab, Inc. liquid powder tracing dye yellow green is the approved color for use on campus. Norlab, Inc. recommends using 1 oz. dye per 250 gallons of water or 1 oz. of dye per 100 gallons of water with high turbidity. If additional dye colors are needed or proposed for use – they must be approved by EHS, prior to use. **Absolutely no other materials or substances such as soaps may be used for testing of the sanitary or storm lines without written approval from U-M EHS**.

5. Check for dye downstream of the testing location in manholes on the storm and sanitary systems to determine the sewer line connections. The time required for monitoring will vary, depending on flow in the lines that are tested. In order to make sure the test is properly conducted, the individual checking the downstream manholes should be in place prior to the introduction of the dye. Based on the circumstances at each location, additional people may be needed to monitor multiple locations. It is recommended that radios or cell phones be utilized to maintain contact during the dye test.

6. For projects primarily testing sanitary connections, a vacuum truck is not required. However, for projects primarily testing storm connections, a vacuum truck may be required to be on-site for the removal of dye colored water from the storm water drainage system. Please consult EHS, EP3 on whether or not a vacuum truck or other method is required. If a vacuum truck is required, please contact the Utilities Department at 734-647-1348 to arrange for the U-M vacuum truck (or contractor's truck) to be on-site during the proposed dye test. If a vacuum truck is required, have the vacuum truck available and positioned by what is thought to be a downstream storm water manhole. If necessary, use the vacuum truck to remove any of the water and dye from the storm water system prior to it reaching a water body. Discharge the dye and water mixture to an approved sanitary sewer location.

NOTE: **EHS requires written follow-up of all findings, even if no cross-connections are found**. **All illicit connections must be reported to EHS, EP3 immediately.** Provide information about the actions that will be taken to prevent an illicit discharge (if possible) and to correct the cross connection.

EHS, EP3 will verbally notify the MDEQ Jackson District Supervisor within 24 hours of any confirmed illicit connection that is suspected of being a danger to health or the environment as specified under U-M's NPDES permit. For discharges that do not pose imminent danger to health or the environment, EHS, EP3 will provide notification to the MDEQ Jackson District Supervisor, verbally or in writing, within 5 days of discovery. Written documentation will be submitted to the MDEQ within 14 days in either case. This information is also included in the storm water permit reports which are submitted to the MDEQ on a regular basis.

These dye testing guidelines will be reviewed on a periodic basis to determine if any modifications are required. Contact EHS, EP3 at 734-936-1920 or stormwater@umich.edu with any questions regarding this guideline.

Verification of Guideline Review

Each person involved in the dye testing event should complete the information in the table below. Please either fax the completed form below to EHS, EP3 at 734-763-1185 or scan and email to stormwater@umich.edu. Your signature on this document indicates that you have reviewed the storm water system dye testing guidelines and agree to follow these guidelines.

Name			
Company			
Email Address			
Phone Number			
Signature			
Date			

Name			
Company			
Email Address			
Phone Number			
Signature			
Date			

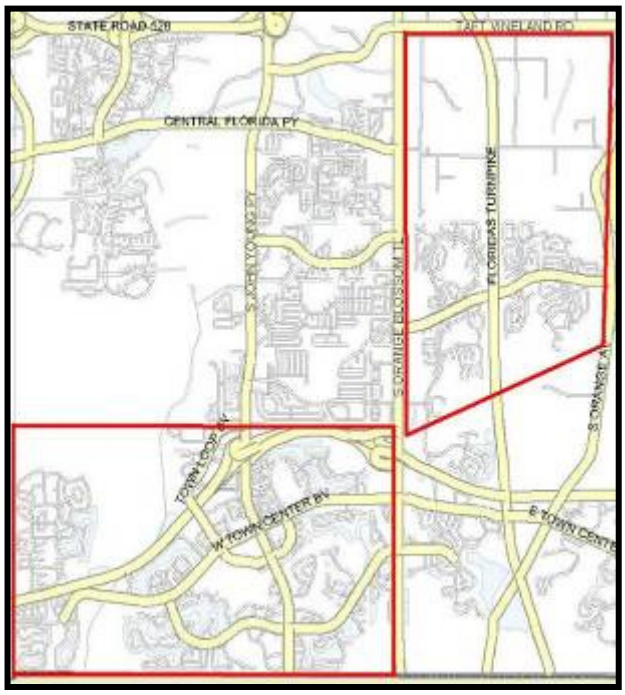
Smoke Testing SOP

SMOKE TESTING STANDARD OPERATING PROCEDURE

Based on the Smoke Testing conducted in #58166 SMOKE TESTING in Southern Service Area

AREA SELECTION

This may be a result of specific project in the design phase or the result of areas connected to the existing project.



In the case of Project #58166, subareas to the master pump station were tested due to issues during and immediately following rain events. SCADA provided the list of pump stations with excessive run times which pumped to the MPS in question. These pump stations were collected and mapped for location. In addition to the stations with excessive run times, several other subareas were tested in order to Smoke the entire region.

Once the area is selected, the OCUD Project Manager will coordinate with GIS. GIS will provide a total count of manholes and linear footage of gravity mains based on GIS data and assets. These quantities will be shared for pricing. GIS will also provide quarter sections maps with customization including house addresses and aerials (shaded 50%). These quarter sections should be plotted immediately prior to smoke testing so the most current information is included and provided to the Contractor.

Project timing is also significant. Smoke will not be evident in areas that are saturated. The optimal scheduling for smoke testing is during the dry season. The purpose of testing is to locate not only surface features including illegal connections and broken cleanouts but also issues in the sanitary sewer main, laterals and manholes. In addition, criteria should be developed to determine how long after a rain event that smoke testing may commence.

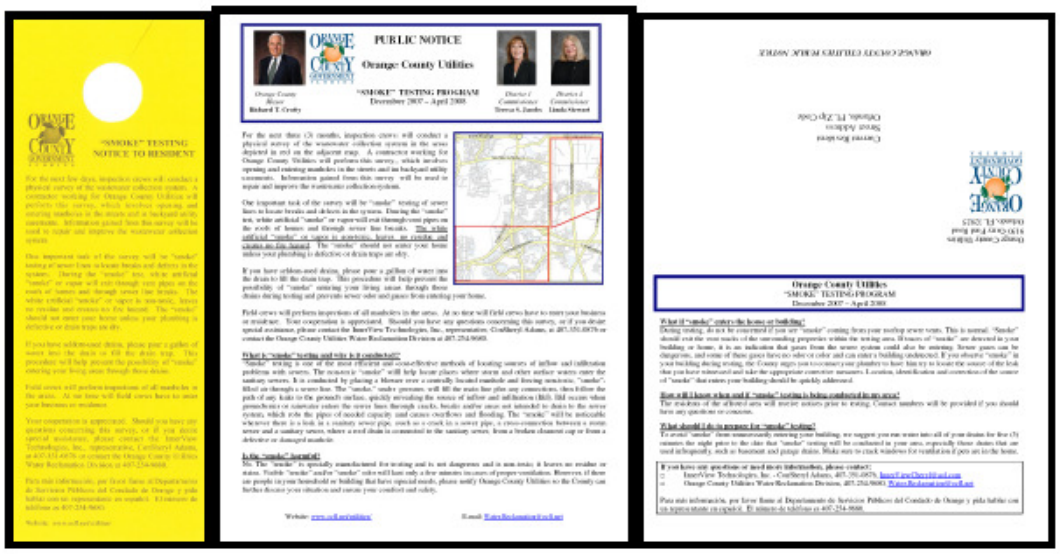
NOTIFICATIONS

This is a critical function of the testing program. OCU customers, General Public, Utilities Water Reclamation, Director's office, Commissioners Office, 911, Fire Department and Utilities Dispatch need to know the purpose, location, dates, procedure and status reports.

- ☐ Director's approval of Public Notification flyer/mailer and door hanger,
- ☐ Commissioners office notification and briefing,
- ☐ Fire Department and 911 contacts and notification,
- ☐ Residents received the public notice as a mass mailing prior to smoke testing
- ☐ Door hangers were hung at each residence 2-4 days prior to smoke testing specific subdivision

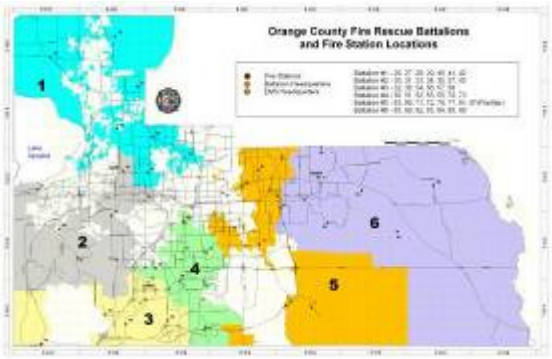
- ☐ Provide Variable Message boards strategically placed throughout testing including major streets into the area and entrances into subdivisions
- ☐ Weekly updates were sent to the Fire Department, 911, Utilities and Testing Company
- ☐ Notification of all parties of project completion

1. The OCUD Project Manager must have the Public Notification flyer / mailer and door hanger approved through the Director's office using the PIO request form and PIO checklist unless an approved template is being utilized.



2. The OCUD Project Manger will contact the Commissioners office and notify the Commissioners that there will be smoke testing in their District. Commissioners need to be notified or briefed prior to the public notification flyers / mailers being sent to the public.

3. The OCUD Project Manger shall provide initial notification to Orange County Fire Rescue and locate the Assistant Chiefs commanding the Fire Stations of the affected area. This may cover several areas depending on the total area to be smoke tested. However, the City of Orlando may also be providing fire service for the area, and coordination is required.

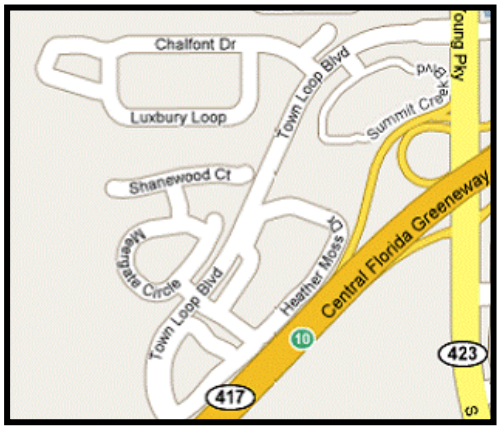


4. The Contractor or OCU shall provide a mass mailing to all residents in the smoke testing area approximately two (2) weeks prior to project start. The Project Manager shall determine if the mailers shall be handled in-house or by the Contractor. The Project Manager will provide residents names and addresses by coordinating with GIS. GIS can export all the information in an excel table for an easy mail merge. Please request customers billing address be provided in addition to the home owner data so that renters are included in the notification process. Note that Customer service's reverse dialing system may also be utilized and a printed note can be placed on Customers Bills, to supplement the public notification flyer / mailer.

5. The Contractor will hang door hangers approximately 2-4 days prior to Testing specific streets.

6. The Contractor shall provide Variable Message Boards (VMB) strategically placed throughout testing including major streets into the area and entrances into subdivisions. Project 58166 covered 75 miles of sanitary sewer (400,000 LF) and 7,300 residents over a 2 month period. The Contractor constantly relocated the three (3) VMB to cover the areas being smoked.

7. The Project Manager shall provide weekly updates to the Fire Department, 911, Water Reclamation contacts, Utilities Dispatch and Testing Company. Work for the upcoming week as well as total progress shall be provided by the Contractor and this information shall be conveyed to all parties on a weekly basis and sent the Friday before the upcoming week by the Project Manager. This included an overall progress map of the entire project progress, narrative describing the week look ahead and a map showing all street names to be tested the following week. The Project Manager is the sole point of contact for all Public Safety and Utilities Departments.



Green = complete
Yellow = In Progress
Red = not started

8. Provide Notification to all parties that the smoke testing is complete. The Fire Department will call immediately if they haven't received the weekly update.

OCUD DOCUMENTATION COLLECTION

The OCUD Project Manager will provide the Consultant or Contractor with the following information to provide a quote.

- ☐ Proposed smoke testing area map,
- ☐ One set of quarter section maps for the purpose of bidding
- ☐ Total Linear Footage of Sanitary Sewer,
- ☐ Total number of Manholes,
- ☐ Total number of Resident Addresses & spreadsheet for Mailers and door hanger count,
- ☐ Requirements for Variable Message Boards,
- ☐ Requirements for the door hanger and 2 page mailer including sizes, color, etc.
- ☐ Three (3) color sets of quarter section maps to the Contractor plotted at the time of smoke testing.
- ☐ Coordination with Water Reclamation for Manhole locates just prior to smoke testing (several manholes were found to be paved over or located in the R-O-W)
- ☐ Coordination with Construction and Water Reclamation during smoke testing for an emergency contact / standby personal to make emergency repairs if required and provide sewer cleaning if line is blocked.

SMOKE TESTING SCOPE OF SERVICES.

Procedures

- ☐ Approved Public Notification Mass Mailers. The Contractor shall mail out to all the residences and businesses in the proposed project area, the approved Smoke Testing public notification flyer / mailers, as a mass mailing approximately 2 weeks before the overall project starts. The mailer shall only be the approved Orange County Utilities smoke testing public notification flyer / mailer and shall be provided by the Project Manager for each project.

- ☐ Door Hangers. The Contractor shall place door hangers on all residences and business 2-4 days prior to smoke testing at those specific addresses. Door hangers shall be an ongoing process throughout the project and shall be limited to the area provided in the look ahead schedule. Door Hangers shall not be placed for areas which will not be tested within 4 days.

- ☐ Smoke Test Setup. The contractor will setup on every other manhole and smoke test no more than 400 ft both directions from setup (Total of 800 LF). This distance shall not be exceeded unless written authorization and field verification is given by the verifying that distances greater than a 400 ft radius are providing acceptable results. The Contractor shall be responsible for Maintenance of Traffic and relocation of variable message boards throughout the duration of the project.

- ☐ Smoke Testing Crew. The smoke testing Contractor shall provide at minimum a crew of four (4) people. One member to man the machine, two (2) to walk and one supervisor. The supervisor will assist in all functions but with primary effort on data collection, logging, determination of smoke testing schedule and tracking.

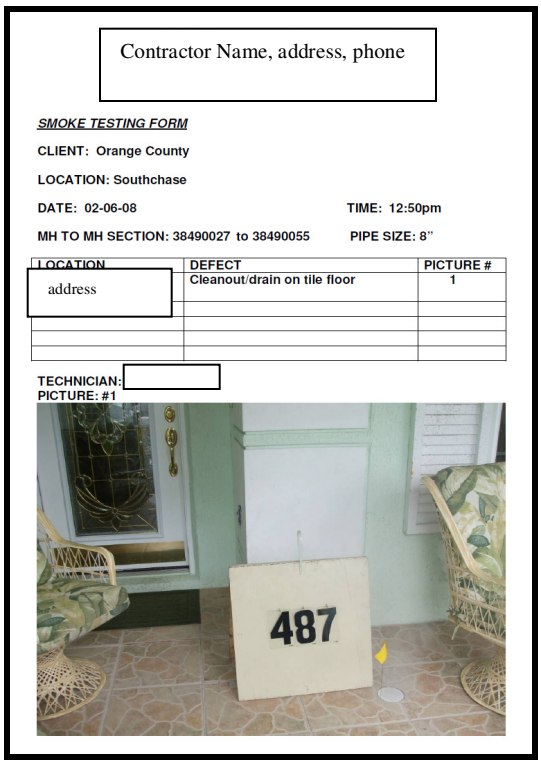
☐ Smoke Testing**.** Smoke will be turned on and remain on throughout the entire time of testing including the walkthrough for identification of defect locations with flags as well as during the taking digital pictures for each flagged and numbered defect.

☐ Identification of Defects. The walk through for locating of defects will not begin until smoke is highly visible with a smoke plume emanating from the plumbing vents of houses at the end of the setup location (maximum 400 ft radius) from the smoke testing machine. A colored locate flag will dropped at the location of the defect and will be left for the homeowner to remove. Walkers shall traverse not only the sidewalk but between all homes and in back yards looking for illegal connections including patio, pool drains and roof drain connections.

☐ Defect Pictures. Once the area has been flagged the Smoke Testing Contractor will snap a digital picture (not less than 2 Megapixel with time and date stamp on the digital photograph) showing the smoke billowing from the defect, flag, unique number, and physical features at or near the defect. Pictures without smoke plume from the located defect or missing visible unique number are unacceptable. The contractor will provide a self standing sign (sandwich board) at each defect with minimum 4" tall numbers physically located at each defect part of the picture. Numbering shall be consecutive, unique number per defect, clearly visible in the picture and noted on the report, record drawings and summary spreadsheet.

☐ Defect Reporting. The report for each defect shall be a MS Word document containing the following information: Contractor letterhead, name of smoke tester, date, time, address of defect, description of defect, manhole to manhole OCU identification, digital photograph, priority rating of defect, Total Drainage Area estimation, quarter section number, footage smoked and map for exact location of defect. Note the map may be of an entire street with multiple defects shown. Weekly reports shall be provided to the Project Manager in digital form as well as 2 hard copies. The Project Manager shall provide one copy to Water Reclamation.

- Common description of defects include: broken cleanout, broken cleanout cap, missing cleanout cap, manhole lid, roof leader, drain connection, AC connection, smoke under sidewalk or driveway, etc
- Common priority ratings and Total Drainage Area estimations include: Priority 1 (illegal connections, direct impact, large drainage area), Priority 2 – High Impact (low lying area, down spouts near cleanout, etc), Priority 3 – Moderate Impact (small impact but potential inflow), Priority 4 - Insignificant (None, no impact).



Contractor Name, address, phone

SMOKE TESTING FORM

CLIENT: Orange County

LOCATION: Southchase

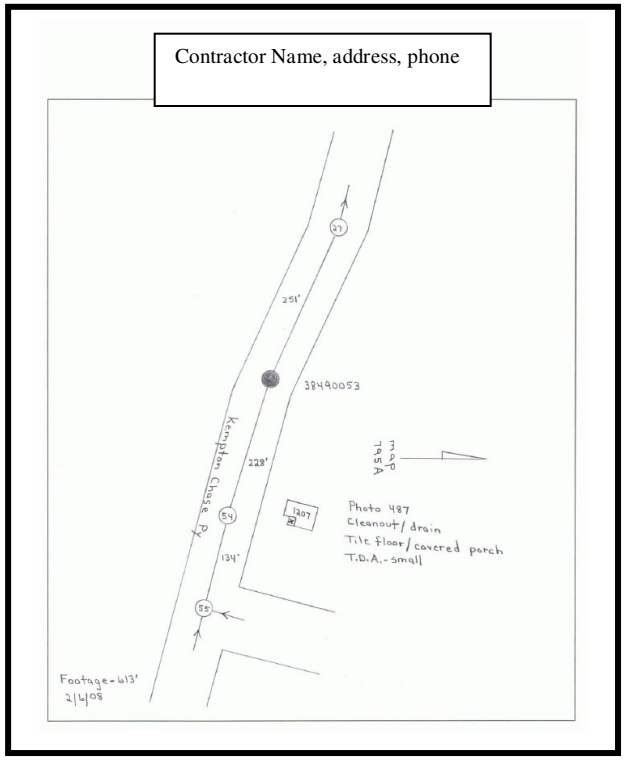
DATE: 02-06-08 TIME: 12:50pm

MH TO MH SECTION: 38490027 to 38490055 PIPE SIZE: 8"

LOCATION	DEFECT	PICTURE #
address	Cleanout/drain on tile floor	1

TECHNICIAN:

PICTURE: #1



Contractor Name, address, phone

☐ Record Drawings and Summary. The Contractor shall return on set of the quarter section maps showing all the defects for the project to the Project Manager. In addition, the Contractor shall provide an Excel table listing the defect number, priority, total drainage area estimation, location, address, and description of defect. The spreadsheet shall be provided each week with the reports and shall be cumulative with a final summary of all defects at the end of the project.

Defect / Pic #	Priority	Total Drainage Area	TDA Notes	Location	Address	Notes
45	1	large	MH ditch			MH #22 in ditch
46	3	small				cleanout
47	3	small				cleanout
48	3	small				MH #11 Below Grade
49	3	small				cleanout
50	4	nil				Broken C.O.
51	2	low area				Broken C.O.

☐ Project Coordination. The Contractor shall provide a one week look-ahead schedule and coordinate with the Project Manger the exact locations of Smoke Testing for the upcoming week. This information will be transmitted to the Fire Rescue Department by the Project Manager.

REQUEST FOR QUOTES (RFQ)

The RFP will contain the following bid items based on the scope of services as well as minimum details for the smoke testing procedure:

☐ Cost per foot for smoke testing LF
☐ Cost for mailer and door hanger LS

- ☐ Cost for variable message boards Per Month
- ☐ Final Report, Excel Summary and Record DWGS LS
- ☐ Acknowledgements of Contractor Responsibilities and Scope of Services
    - Responsible for all MOT including traffic control, barricades, flagmen, traffic cones, police, etc
    - Providing all flags, equipment, chemicals, water, fuel and all appurtenances to be included in the per foot cost
    - Responsible for protecting the public from open manholes
    - Responsible for any special permits or licenses
    - Coordination with Schools and high traffic roads for testing on weekends only
    - Providing a phone number for information and point of contact onsite during testing for the public

UTILITY INSPECTOR

As with any project, there are several procedural errors or shortcuts that can be made which will detrimentally affect the outcome. The inspector will verify the procedures are being followed by the Contractor including, running the smoke the entire time, effectiveness of the walkers, verify backyards and side yards are being investigated, speaking with the public and documentation. The project schedule shall be coordinated by the Project Manager with Construction to verify the specifications are being adhered.

In 58166, we provided a full time inspector as well as a part time representative from Water Reclamation. Both Utilities representatives were looking for defects, calling in critical defects to be repaired immediately, speaking with the public about the project and directly responding to customer calls to the Smoke Tester PIO as well as the Water Reclamation hotline. In addition, we corrected several issues with the smoke tester procedures. The first was the duration of the smoke. The walkers were leaving before the smoke had reached the end of the area to be tested and were missing vital defects. There is a time lag from when the machine is started until the smoke fills the volume of the gravity collection system, laterals, house plumbing and reaches the final point of the testing area. The coordination between the Contractor in charge of running the smoke test machine and the walkers was not efficient. In one instance, they ran out of smoke and the walkers continued looking for defects even though no smoke was in the system. Finally, the machine was being turned off immediately after the flagging was finished. In some instances, the defect (broken later under a sidewalk, manhole shifted cone section or deep cleanout) were not readily apparent without the presence of smoke. The defect pictures must show smoke to identify the specific defect and show proof that there is an issue.

GPS COORDINATES

In 58166, the Prime Contractor shot GPS coordinates of each defect as well as took coordinates for every manhole and lift station in the testing area. This task was a full time position and required the Contractor to provide the GPS Trimble equipment. The need to locate both the existing facilities as well as the defects is a coordination effort by the Project Manager with both GIS and Water Reclamation. In addition, the GPS Technology is not normally a service provided by Smoke Testers, so the additional cost for a sub will have to be evaluated by the Project Manager and the need for the Utility.

DATA ANALYSIS

The Project Engineer is responsible for analyzing the defects found during smoke testing, verifying priority, and creating a column on the summary spreadsheet for responsibility. Illegal connects or cleanout issues at the home are the responsibility of the homeowner to repair. The cleanouts at the R-O-W line, defects found under sidewalks or driveway aprons, manholes, etc are the responsibility of Utilities to repair. The Project Manager will sort the summary spreadsheet by responsibility and priority. This information shall be coordinated through both Water Reclamation for scheduling of repairs as well as with the Water Reclamation Environmental Compliance section for residential compliance and verification of repairs. The project manager shall ensure that the digital data is filed on the digital network under the appropriate sequence number.

PROJECT CLOSEOUT

The Project Manager shall have a closeout meeting and pass all the information including spreadsheet, record drawings and Final Report with pictures to Water Reclamation. Water Reclamation will schedule repairs that are the responsibility of the Utility and coordinate the compliance action with homeowners responsible for private property repairs.

The results for #58166

Priority of Defect	Description	ROW / Easement	Private Property	Total	Percent
Priority 1 - Illegal Connections	Direct Connection (Roof Gutters, porch / pool drains, plumbing, etc)	0	20	20	1.6%
Priority 1 - Direct Impact	(Ponds nearby, large depressions, parking lots, MH in drainage)	45	10	55	4.5%
Priority 2 - High Impact	(Low areas, down spouts near cleanout, etc)	527	186	713	58.4%
Priority 3 - Moderate Impact	Small impact but potential inflow	134	221	355	29.1%
Priority 4 - Insignificant	Above grade or high ground, No observable impact	8	70	78	6.4%
Total		**714**	**507**	**1221**	100%

Priority 2 –Impact – Low Areas. Note swale between houses

Priority 2 – Impact (Low Area) Note screen on cleanout and swale between houses

Priority 3 – Small Impact
Good drainage to lake. Small impact.

Priority 4 – No Impact – No drainage Area.
Homeowner to repair c/o on house

Priority 1 - Illegal connections